



SAMPLING AND ANALYSIS PLAN REVISION 0

**CAN CLAY FACILITY
402 WASHINGTON STREET
CANNELTON, INDIANA 47520**

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Table of Contents

1	INTRODUCTION.....	1
2	BACKGROUND.....	4
3	SAMPLING AND ANALYSIS PLAN.....	5
3.1	UTILITIES.....	5
3.2	HEALTH AND SAFETY.....	5
3.3	WORK ZONES.....	5
3.4	GEOPHYSICAL SURVEY.....	5
3.5	INVESTIGATION LOCATIONS.....	6
3.6	SUBSURFACE INVESTIGATION PROCEDURES.....	7
3.6.1	Soil Sampling.....	7
3.6.2	Groundwater Sampling.....	8
3.7	ANALYTICAL PROCEDURES.....	9
3.8	DECONTAMINATION PROCEDURES.....	9
3.9	INVESTIGATION DERIVED WASTE.....	10
3.10	SAMPLING LOCATION SURVEY.....	10
4	DATA QUALITY OBJECTIVES.....	11
4.1	FIELD OBSERVATIONS AND DOCUMENTATION.....	11
4.2	EQUIPMENT CALIBRATION.....	11
4.3	QA/QC SAMPLES.....	12
4.3.1	Trip Blanks.....	12
4.3.2	Field Duplicates.....	12
4.3.3	Matrix Spike/Matrix Spike Duplicates (MS/MSD) or Laboratory Duplicates.....	12
4.4	SAMPLE PACKAGING AND SHIPMENT.....	13
4.5	CHAIN OF CUSTODY PROCEDURES.....	14
4.6	LABORATORY QUALITY ASSURANCE AND DELIVERABLES.....	14
4.7	ANALYTICAL RESULTS.....	16
5	DATA QUALITY ASSESSMENT.....	17

Figures

Figure 1 Proposed Boring Locations

Tables

Table 1 Proposed Sampling Program

Appendices

Appendix A Health and Safety Plan

1 Introduction

In accordance with a request by the Indiana 15 Regional Planning Commission, ATC Group Services LLC (ATC) has prepared this Sampling and Analysis Plan (SAP) to investigate the *recognized environmental conditions* (RECs) and ASTM Non-Scope Environmental Conditions identified in ATC's Phase I Environmental Site Assessment (Phase I ESA), dated August 6, 2019, performed at the Can Clay Facility located at 402 Washington Street in Cannelton, Perry County, Indiana (Site). Specifically, the RECs or ASTM Non-Scope Environmental Conditions included the following:

- Based on User provided information, interviews and historical records, the Site appears to have been associated with clay pipe manufacturing from 1906 to 2019. Prior companies including Cannelton Sewer Pipe (1906-1950s), Can-Tex (1950s to 1980), and Can Clay Corporation (1980 to 2019) historically operated on the Site.

Available fire insurance maps depict the Cannelton Sewer Pipe Company on the central portion of the Site from 1909 to 1950. Other facilities identified on the Site included a cotton batting mill (1886 to 1909), a machine shop and foundry (1886 to 1909), a railroad depot (1909 to 1950), an automotive repair shop with a gasoline tank in 1950. Notable surrounding facilities identified on available fire insurance maps included a Standard Oil Facility (1925 to 1950) on the north adjacent Site and the Indiana Cotton Mill (1886 to 1950) on the south adjacent Site. It should be noted that the Indiana Cotton Mill also used the east portion of the Site as a boiler house, a blacksmith shop, coal storage, and a warehouse until circa 1950.

Past industrial uses, maintenance operations, and fueling operations associated with the Site and/or surrounding properties represent a *recognized environmental condition*.

- The Site was listed in the Underground Storage Tank (UST) database as facility identification number 10265. One 10,000 gallon gasoline UST, one 10,000 gallon diesel UST, one 15,000 gallon diesel UST, and one 500 gallon acetone UST were listed as permanently out of service. The USTs were reportedly closed in December 1988. According to the file review on the Indiana Department of Environmental Management (IDEM) Virtual File Cabinet (VFC), the USTs were reported to have operated since the 1960s. No evidence of confirmatory sampling associated with the UST closures was identified during the file review. Multiple air permits were on file from 1989 to 2019 for the facility. Based on a Findings of Fact and Order, dated August 9, 1989, the IDEM observed fugitive sawdust on the Site (east portion) which extended across the Site boundary. According to a Findings of Fact and Order, dated December 21, 1993, the IDEM observed a high opacity smoke carried by the wind that resulted in a downwash which carried at ground level onto an adjacent Site.

The Downtown Shell facility (south adjacent property) at 124 Fourth Street was listed in the UST database as facility identification number 11009. Three 4,000 gallon gasoline

USTs and one 500 gallon used oil UST were listed as permanently out of service. The USTs were reportedly closed in November 1988. No evidence of confirmatory sampling was identified regarding the closure of the gasoline USTs. The south adjacent property is considered to be upgradient from southern portions of the Site.

The reported violations associated with stored sawdust debris and smoke emissions, and lack of closure documentation regarding the on-Site and south adjacent USTs represent *recognized environmental conditions*.

- Several pole and pad-mounted transformers, owned and operated by Can Clay Corporation, were observed on the Site. Stressed vegetation was observed beneath the transformers north of Adams Street near the former oil pump house. Stressed vegetation observed beneath on-Site transformers represents a *recognized environmental condition*.
- Multiple chemicals including dimethylaniline (DMA), cobalt, PolyLite® (resin), isopropanol, organic peroxide, Tolusol®, acetone, motor oil, hydraulic oil, and used oil were observed stored in various containers ranging from one gallon cans to 55-gallon drums. Multiple ASTs were also observed on the Site storing elevator oil, used oil, hydraulic oil, and water. The majority of the containers and ASTs were observed in or near the production building, the tunnel kiln, and the maintenance shop. Poor housekeeping was observed on the Site with evidence of chemical spillage from past operations. Multiple containers were observed with no labels or lids on the Site. Staining was observed on the floors and pit areas of the facility buildings next to several observed containers, equipment, and production areas. Staining was also observed on exterior slab areas. Poor housekeeping associated with container storage and excessive staining in the facility buildings and exterior slab areas represents a *recognized environmental condition*.
- Miscellaneous debris including clay and pipe debris, abandoned equipment, and trash were observed across the Site. Evidence of poor housekeeping and waste mismanagement was observed throughout most of the facility. Fill piles consisting of clay, pipe, and sawdust debris were observed on the south end of the Site near the clay shed. Unknown fill material was also observed south of the maintenance shop. According to Mr. Lewis, the west portion of the Site near the Ohio River was used as a clay dump area. The observed miscellaneous debris across the Site represents a *recognized environmental condition*.
- ATC observed subgrade concrete pits beneath portions of the production building. A black material was observed in the pits. According to Mr. Lewis, the black material is a wood residue generated from past drying operations during pipe construction. The black material observed in the pit areas beneath the production building represents a *recognized environmental condition*.

- ATC observed multiple drains in the facility buildings and exterior slab areas. Black oily staining was observed on the concrete floor around floor drains in the maintenance shop. Staining was also observed around several drains in the production building and tunnel kiln. Mr. Lewis was unsure where the drains discharge, but assumed they would discharge to the sanitary sewer system. The oily staining near the floor drains constitutes a potential release to the sewer system and subsurface, which represents a *recognized environmental condition*.
- The following potential subsurface vapor migration sources are considered to represent a *recognized environmental condition*.
 - Past use of fuel USTs on the Site and south adjacent Site and lack of closure documentation.
 - Past use of a fueling station, automotive repair shop, and maintenance garage on the Site.
 - Past use of multiple solvents at the Site facility and observed staining/poor housekeeping.
 - Past use of a bulk oil storage facility on the north adjacent Site.
 - Past use of a parts washer and hydraulic equipment in the production building.
- Suspect asbestos containing materials (ACMs) were identified at the Site in the form of resilient floor tile, pipe insulation, ceiling tile, plaster, drywall, wall insulation, window glazing, and asphalt roofing. Suspect ACMs were observed to be in fair to good condition throughout the building. Based on the age of the Site buildings (10 of 11 buildings from ca. 1909 to 1969), ACMs are likely to be present at the Site.
- Based on the age of the buildings (10 of 11 buildings from ca. 1909 to 1969), there is a potential for lead-based paint (LBP) to be present at the Site. Painted surfaces at the Site were observed in poor to fair condition.
- Based on observations made during the site reconnaissance, mold appears to be present on the Site.

The work and all documents prepared during this scope of work are being funded by the Indiana 15 Regional Planning Commission, which received Hazardous Substance and Petroleum Grant funding from the United States Environmental Protection Agency (US EPA) (U.S. EPA Grant No. BF00E02383-0). This SAP has been prepared in accordance with Indiana Department of Environmental Management's (IDEM's) *Remediation Closure Guide* (RCG), dated March 2012 (updated March 2019), and provides an outline of the objectives, project organization, functional procedures, quality assurance (QA) and quality control (QC) protocols for sampling, sample handling and storage, chain of custody, and field/laboratory testing and analysis procedures. QA/QC procedures identified herein accommodate applicable professional technical standards, IDEM requirements, government regulations and guidelines, and incorporate specific project goals.

2 Background

A Request for Eligibility for the Site was submitted to the Indiana Brownfields Program (IBP) on April 22, 2019 for review and acceptance. The IBP accepted the Eligibility Determination Request on May 23, 2019.

The Phase I ESA, dated August 6, 2019, identified the Site as a former clay pipe manufacturer totaling approximately 32.7 acres. Eleven (11) buildings totaling approximately 237,374 square feet are located on the Site. The buildings were constructed from 1909 to 1987 and are mostly unoccupied except the stick shed is used for wood pallet manufacturing. Several of the buildings were observed in poor shape with partially collapsed walls and damaged roofs. Multiple kilns and a sawdust silo are still present on the Site. A large lay-down yard storing mostly clay pipe product is located on the north half and central portion of the Site. Dense vegetation and trees are present across the lay-down yard due to its low utilization. Stored equipment and multiple containers (55-gallon drums and buckets) were observed in many of the buildings on the Site and are used to store various substances including waste oil, hydraulic oil, trash, and resin among others.

The objective of the scope of work described in this SAP is to evaluate the soil and groundwater quality in the vicinity of the RECs. Once the Site is characterized and the environmental issues are resolved, the Site is expected to be used for commercial/industrial purposes.

3 Sampling and Analysis Plan

This SAP describes sample collection and laboratory analysis of soil and groundwater samples to evaluate the current Site conditions in comparison with the applicable IDEM RCG screening levels. Specifically, the results of the laboratory analyses will be compared to the IDEM RCG screening levels for both residential and commercial/industrial land use. This SAP is presented to define the field activities to be conducted and protocol to be followed in order to accomplish the Data Quality Objectives (DQO) outlined in **Section 4.0**. Section 4.0 provides guidance for personnel assigned to conduct the activities and discusses, in detail, the procedures and specifications required to achieve the level of QA necessary for the data generated. Clear sampling and analysis procedures must be used to ensure proper QA is adhered to and that field tasks are conducted so as to certify that all data generated is of sufficient quantity and quality to satisfy the project objectives. Accordingly, all field activities including boring, drilling, and sampling operations will be conducted or supervised under the direction of an Indiana Licensed Professional Geologist.

3.1 Utilities

Prior to initiating any underground Site activities, ATC will contact the Indiana Underground Plant Protection Service (IUPPS) and request the member utilities to identify the underground utility locations in the rights-of-way surrounding the Site. If necessary, ATC will also contact a private locating contractor to locate on-Site utilities prior to beginning subsurface activities at the Site.

3.2 Health and Safety

The Health and Safety Plan (HASP) included in **Appendix A** has been developed to identify potential human health and worker hazards and to describe appropriate worker personal protective equipment and safety protocols. The HASP for subsurface investigation addresses worker safety during field sample screening, sample collection, and associated testing. The HASP also addresses potential field hazards related to heavy equipment operation, vehicular and pedestrian traffic volumes and patterns, and common biological exposures (snakes, ticks, poisonous plants, etc.). Personnel involved with the subsurface investigation will hold a health and safety meeting prior to beginning work each day.

3.3 Work Zones

To reduce the accidental spread of potentially hazardous substances by workers and equipment, work zones will be established, and the flow of personnel among the zones will be controlled. The establishment of work zones will help ensure that personnel are properly protected against hazards present, work activities and contamination are confined to controlled areas, and personnel can be located and evacuated in case of an emergency.

3.4 Geophysical Survey

A geophysical survey of the suspected UST areas was completed by Prism Geolmaging, Inc. on August 21, 2019 to determine if tanks remain on the Site. The geophysical survey included the use of ground penetrating radar (GPR) and EM-61 survey equipment. According to the geophysical survey, three (3) USTs were confirmed under the southwest portion (one UST) and maintenance

garage area (two USTs). Two (2) subsurface anomalies were also identified at the Site south of the Old Machine Shop building and north of the Joint Building that require additional investigation to determine if USTs are present at those locations. The presence and location of any existing tanks and other subsurface structures will be considered to finalize appropriate sampling locations to evaluate the soil and groundwater quality beneath the Site.

3.5 Investigation Locations

UST Investigation

To assess the soil and groundwater quality in the immediate vicinity of the USTs, samples will be collected in accordance with the Indiana Administrative Code Title 329, Article 9 (329 IAC 9). Because of the inherent danger of drilling near buried structures that likely contain unknown sludge and liquid, ATC will remove the tanks that are safely accessible to prevent injuries to our workers and subcontractors, and minimize potential damage to the environment. The UST located on the southwest portion is not expected to be removed during this assessment due to safety concerns associated with the nearby building foundation/overhead utility lines.

UST closure activities will be conducted in accordance with the IDEM compliance requirements regarding UST closure. ATC will contact the IDEM UST Section, the Office of the State Fire Marshal (OSFM) and the local fire department prior to any UST closure activities.

According to 329 IAC 9, the assessment of soil quality in the vicinity of the UST will include the following:

- Bottom Samples:
 - USTs >10K capacity-one (1) sample within two (2) feet below each end of each UST and one (1) sample within two (2) feet below the center of the UST.
 - USTs ≤10K capacity-one (1) sample within two (2) feet below each end of each UST.
- Sidewall Samples:
 - UST pit perimeter <80 feet - four (4) sidewall samples taken at a point half the distance from the surface to the bottom of the UST excavation.
 - UST pit perimeter ≥80 feet - one (1) sidewall sample for every twenty (20) linear feet from halfway between the surface and the bottom of the UST excavation.

ATC estimates four (4) base samples and twelve (12) sidewall samples will be retained for laboratory analyses.

Phase II Subsurface Investigation

The subsurface investigation to evaluate the soil and groundwater quality at the Site will include the collection and analysis of up to sixty-four (64) soil samples and thirty-two (32) groundwater samples from thirty-two (32) proposed soil boring locations (see **Figure 1**).

The soil borings will be advanced to a depth of 30 feet below ground surface (bgs) or five (5) feet below the groundwater surface, whichever is shallower. The proposed soil borings will be converted into temporary monitoring wells.

Although the general soil boring layout has been developed to focus on areas most likely to have been adversely impacted by Site operations, the location of each soil boring will be determined in

the field based on access, subsurface and above-ground utility locations, and field conditions. The proposed sample locations and rationale are provided below:

- Seven (7) soil borings (7 temporary monitoring wells) will be advanced on the north portion of the Site to evaluate subsurface conditions in the lay-down yard area.
- One (1) soil boring (1 temporary monitoring well) will be advanced on the north end of the Site near the adjacent former bulk oil storage facility.
- Two (2) soil borings (2 temporary monitoring wells) will be advanced near the former auto station and gasoline tank (1950 fire insurance map) near the tunnel kiln building.
- Five (5) soil borings (5 temporary monitoring wells) will be advanced near the production building on the south-central portion of the Site.
- One (1) soil boring (1 temporary monitoring well) will be advanced southwest of the production building to evaluate the subsurface conditions near the 15,000 gallon fuel oil UST.
- Two (2) soil borings (2 temporary monitoring wells) will be advanced to evaluate subsurface conditions near stressed vegetation associated with the transformer and the former pump station near Adams and North 4th Street.
- Four (4) soil borings (4 temporary monitoring wells) will be advanced to evaluate the subsurface conditions on the central portion of the Site.
- One (1) soil boring (1 temporary monitoring well) will be advanced near the old machine shop to evaluate past uses of the gasoline tank (1950 fire insurance map).
- Two (2) soil borings (2 temporary monitoring wells) will be advanced near the clay dump area and former railroad depot on the southwest portion of the Site near the Ohio River.
- Four (4) soil borings (4 temporary monitoring wells) will be advanced to evaluate the subsurface conditions near the maintenance shop, storage building, and gasoline/diesel USTs on the east end of the Site.
- Three (3) soil borings (3 temporary monitoring wells) will be advanced on the south end of the Site near the clay shed and debris piles.

3.6 Subsurface Investigation Procedures

Samples will be collected in accordance with IDEM RCG, as described in the Quality Assurance Project Plan (QAPP), dated January 2, 2019, which was conditionally approved by US EPA on February 14, 2019.

3.6.1 Soil Sampling

Each boring will initially be advanced using a stainless steel hand auger to a maximum depth of approximately four (4) feet bgs to minimize the potential hazards associated with buried utilities. The soil borings will then be advanced and soil samples collected continuously to the desired depth using a track mounted Geoprobe® drill rig equipped with

5-foot long, nominal 2-inch diameter Macro-core® samplers. The Macro-core® samplers shall be equipped with new plastic internal liners prior to collection of each sample.

Soil samples from a minimum of each 2-foot interval will be collected and evaluated for potential submittal to the laboratory for analysis. Each sample collected will be labeled and placed in a cooler with ice for preservation following collection. A portion of the remaining sample will then be inspected for physical evidence of contaminants such as staining, odors, free product, etc., and will be placed into a re-sealable plastic bag for field headspace screening. Soil headspace measurements will be collected for the emission of total photo-ionizable vapors (TPVs) using a photo-ionization detector (PID) which measures TPVs in parts per million (ppm). The inspection information, soil field descriptions, and headspace measurements will be recorded on boring logs generated for each boring location.

Two (2) soil samples from each of the thirty-two (32) soil borings will be retained for laboratory analysis. The samples retained for analysis will include the surface sample (collected from the 0 to 2 feet bgs depth interval) and the subsurface sample exhibiting the greatest potential for being impaired (i.e., highest TPV reading, staining, odors, etc.) based on field screening measurements and/or field observations. If no evidence of impact is observed, then the subsurface sample will be collected above the groundwater surface or bottom of boring (if dry).

The samples retained for analysis will be containerized with minimal headspace in sample containers provided by the laboratory, sealed using Teflon®-lined caps, labeled with a unique identification, placed in an ice-packed cooler and transported to Pace Analytical Services, Inc. (Pace) located in Indianapolis, Indiana using appropriate chain of custody protocol. Soil samples to be analyzed for volatile organic compounds (VOCs) will be collected in accordance with US EPA SW-846 Method 5035 (Indiana Modified). Laboratory analyses will be performed on a standard two-week turn around basis.

3.6.2 Groundwater Sampling

If groundwater is encountered and conditions permit, i.e. sufficient water is produced, ATC will collect a groundwater sample from each of the thirty-two (32) proposed temporary monitoring wells. The locations of the proposed wells are provided on **Figure 1**. Each temporary well will be constructed of 1-inch diameter polyvinyl chloride (PVC) riser and 5-feet of machine-slotted screen. The groundwater samples will be collected using a low flow/low stress sampling methodology. The water samples will be placed in appropriate sample containers, labeled with a unique identification, placed in a cooler and transported to Pace using the appropriate chain of custody controls. Laboratory analyses will be performed on a normal two-week turn around basis.

After the samples are collected, a licensed water-well driller will return to the Site to properly abandon the temporary wells.

3.7 Analytical Procedures

All soil and groundwater samples will be placed in the appropriate laboratory containers, logged on a chain of custody, placed in a cooler with ice to maintain a temperature of approximately 4° Celsius, and transported to Pace or AES for analysis.

All environmental media samples will be analyzed within the established holding times using US EPA-approved Methods as described in the EPA publication *Test Methods for Evaluation of Solid Wastes, Physical/Chemical Methods (SW-846, 3rd Edition, Update III)*.

Up to sixty-four (64) soil samples (2 per boring) and thirty-two (32) groundwater samples (from 32 temporary monitoring wells) will be analyzed for the following parameters:

- VOCs in accordance with US EPA Method 8260,
- Polynuclear aromatic hydrocarbons (PAHs) in accordance with US EPA Method 8270SIM, and
- RCRA (8) Metals in accordance with US EPA Methods 6010B and 7470.

Twelve (12) of the sixty-four (64) soil samples to be collected from near the transformers/former pump station and the maintenance garage will also be analyzed for polychlorinated biphenyls (PCBs) in accordance with US EPA Method 8082.

In addition to the sixty-four (64) soil samples and thirty-two (32) groundwater samples described above, four (4) duplicate soil sample, two (2) duplicate groundwater sample, five (5) trip blanks, and six (6) matrix spike/matrix spike duplicate samples (4 soil, 2 water) will be submitted to Pace for analysis. A summary of the proposed sampling program and applicable QA/QC samples is provided as **Table 1**.

The Method Detection Limits (MDLs) and Estimated Quantification Limits (EQLs) shall be low enough to determine if the reported concentrations of the contaminants of concern (COC), if any, are in excess of the RCG Screening Levels. QA/QC shall be performed and submitted for review in accordance with IDEM's RCG, and in accordance with the **Level IV full data package criteria**.

3.8 Decontamination Procedures

Sampling equipment and supplies (i.e. gloves, hand augers, etc.) will be dedicated to a specific sample location, disposed of after use or decontaminated between sample collection. Sampling personnel will wear clean latex or nitrile gloves at any time they are handling equipment or containers, and will take all precautions to avoid contamination of equipment and supplies. Geoprobe® sampling equipment, which enters each borehole, will be cleaned prior to drilling. The sampling equipment will also be cleaned between sample intervals using a solution of non-phosphate detergent and rinsed in potable water. Parts or surfaces of the portable non-dedicated equipment that come in contact with soil will be decontaminated between sample collection points by washing with a non-phosphate detergent wash, followed by a rinse in potable water.

3.9 Investigation Derived Waste

It is anticipated that creation of investigation derived waste from the proposed sample collection activities will be kept at a minimum. However, used personal protective equipment (PPE), disposable sampling equipment, and decontamination fluids will be gathered and double bagged where appropriate and placed in a 55-gallon drum temporarily staged on-Site prior to collection and proper off-Site disposal.

3.10 Sampling Location Survey

The location of each soil boring will be recorded using a global positioning system (GPS) unit.

4 Data Quality Objectives

This section discusses DQO's for sampling and analysis of subsurface soil and groundwater samples from the areas of interest identified during the Phase I ESA. The following types of data will be generated in the course of this investigation:

- Field observations and geologic and hydrogeologic conditions, including soil characteristics and COC indicators;
- Field meter readings including those for measurement of water levels, basic water chemistry, and TPV headspace screening;
- Field records of on-Site activities including well construction, sample collection, sample handling, and other activities directly tied to the generation of data or the proper context of data; and
- Results of laboratory analysis of soil and groundwater samples.

The quality objective for these data types are discussed below and in further detail in the QAPP, dated January 2, 2019, which was conditionally approved by US EPA on February 14, 2019 for the Indiana 15 Regional Planning Commission (U.S. EPA Grant No. BF00E02383-0).

4.1 Field Observations and Documentation

Field documentation will be crucial to ensure the integrity of samples and the associated analytical results. For these sampling tasks, documentation will include field logbooks, field data collection forms, field meter calibration information, and chain of custody documentation. The quality of field observations of geologic and hydrogeologic conditions relies heavily on the training and experience of the personnel responsible for those activities. Criteria for performance are established through standard operating procedures (SOPs) for the applicable activities presented in **Section 3.0** of this SAP. The quality objectives for these data types will be to maintain adherence to the applicable procedures and to maintain proper documentation.

4.2 Equipment Calibration

The quality of field meter readings relies on the proper calibration and operation of equipment. Equipment used to gather, generate, or measure environmental data will be calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications.

At a minimum, each instrument will be calibrated in the laboratory or office prior to each sampling event and operate in accordance with the manufacturer's specifications. Equipment used during the field sampling will be examined daily to certify that it is in operating conditions and calibrated according to manufacturer's instructions. If equipment malfunction is suspected and calibration failure occurs, equipment will be removed from service and substitute equipment will be obtained. Calibration activities will be recorded in the appropriate field forms or logbook(s).

4.3 QA/QC Samples

To provide for a measurement of the precision and accuracy of the sampling event, the following QA/QC samples will be submitted for analysis along with environmental media samples.

4.3.1 Trip Blanks

- 1) Intent: Expose handling or transportation induced deterioration of the sample.
- 2) Method: Before the start of sampling, the laboratory will provide a blank TerraCore Sampling Kit (1 vial with 25milliliters (mL) methanol and 2 vials with 5mL of deionized water) to serve as a trip blank for soil samples, and a deionized water sample trip blank set for water samples. These blanks will be sent from the laboratory to the Site, and will be submitted for analysis by the field sampling team. Trip Blanks will be analyzed for VOCs only.
- 3) Frequency: The trip blank for soil sampling will be one unused TerraCore Sampling Kit per bottle lot, and the trip blank for water samples will be one 40 mL vial of laboratory supplied deionized water for each day of sampling and/or for each cooler used to store and transport water samples for VOC analysis.

4.3.2 Field Duplicates

- 1) Intent: Expose deficiencies in the sample collection and laboratory analysis that influence sample precision.
- 2) Method: Field samples will be collected for a replicate analysis from selected sampling locations. The sample will be collected by filling double the amount of sample containers as called for in the sample plan. One set of samples will be identified as the sample. The second set will be identified as a field duplicate.
- 3) Frequency: One field duplicate will be collected and submitted for every 20 samples collected.

4.3.3 Matrix Spike/Matrix Spike Duplicates (MS/MSD) or Laboratory Duplicates

- 1) Intent: Evaluate laboratory precision, accuracy, representativeness, comparability and completeness (PARCC) of the data parameters generated during this investigation.
- 2) Method: MS/MSD samples will be collected for replicate analysis from selected sampling locations. The sample will be collected by filling triple the amount of sample containers as called for in the sample plan. One set of samples will be identified as the sample. The second and third sets will be identified as MS and the MSD, respectively.
- 3) Frequency: One MS/MSD sample will be collected and submitted for every 20 samples collected from each sampling matrix.

A summary of the QA/QC samples planned for this project is provided in the table below:

QC Sample Type		Frequency of Sample/Analysis	Details
Field Samples	Duplicate Samples	1 duplicate per 20 samples per matrix, or 1 duplicate per sample matrix if fewer than 20 samples.	Duplicate sample to be collected by the same methods at the same time as the original sample. Used to verify sample and analytical reproducibility.
	Trip Blanks	1 trip blank per cooler or per day containing samples for VOC analysis for soil and groundwater samples.	Laboratory prepared organic-free blank to assess potential contamination during sample container shipment and storage. Soil - One unused TerraCore Sampling Kit (1 vial with 5 mL methanol and 2 vials with 5 mL of deionized water) Groundwater – Three 40 mL vials with HCL preservative filled with deionized water
Lab Samples	Matrix Spike/ Matrix Spike Duplicate	1 MS/MSD per 20 or fewer samples per matrix	Laboratory spiked sample to evaluate matrix and measurement methodology.
	Method Blanks	1 method blank per batch of samples prepared, or per lab SOP	Laboratory blank sample to assess potential for contamination from laboratory instruments or procedures.
	Laboratory Control Samples and Duplicates	Analyzed as per method requirements and laboratory SOPs	Evaluates laboratory reproducibility.

4.4 Sample Packaging and Shipment

Once the field sampling crew has filled out all the appropriate sample labeling and custody documentation, the samples will be stored on ice, and shipped to Pace and AES via courier. As the samples are assembled for shipment, the following steps will be conducted:

- 1) Follow all appropriate instructions for collecting the samples.
- 2) Tightly secure the lid of each sample container and confirm that the sample has been properly labeled with the date and time of sample collection.
- 3) Place each sample container inside bubble pack (if container is glass).
- 4) Place the sample containers inside the sample cooler.
- 5) Place bubble wrap, or other suitable material that will maintain its integrity if it gets wet, between each sample container to take up any void space.
- 6) Add ice in the cooler containing the samples.
- 7) Place a chain of custody and any other instructions inside a resealable plastic bag and place the bag inside the cooler.
- 8) Close the cooler and secure closed with shipping tape by running the tape around both ends of the cooler at least two times.
- 9) Place one custody seal across the front of the cooler.

- 10) Place address label with both the "Shipped From" and "Ship To" addresses on the top of each cooler.
- 11) Notify the laboratory that it will be receiving the samples.

4.5 Chain of Custody Procedures

Possession of samples collected during field investigations must be traceable from the time the samples are collected until they or their derived data are summarized and used for data analysis, interpretation, and site decision-making. Chain of custody procedures will be followed to maintain sample accountability.

The custody form will document which individuals were in possession of the samples and when custody was transferred from one individual to another. Any deviations from sampling protocol will also be documented on the custody record. Additionally, the chain of custody form will double as a request for analysis form. The custody form will specify the type and number of bottles shipped, analysis to be performed and turnaround time requirements. The sample custody records will be part of the final report.

Whenever the custody of samples is transferred, the individuals relinquishing and receiving the sample will sign, date, and note the time on the record. Separate records will accompany each sample package shipped to the laboratory. The original custody form will accompany the samples and a copy will be retained by the sampling team.

When shipped by courier, the method of shipment and courier name will be noted in the remarks column. For ground or air courier shipments to the laboratory, the sampling team will complete the chain of custody, place it in the sampling cooler, and seal the cooler with shipping tape and a custody seal. Samples will not be relinquished to the shipping firm; rather, the unbroken custody seal will establish sample integrity during the time that the samples are in transit. Shipping return receipts, freight bills, and bills of lading will be retained as part of the sample custody documentation.

4.6 Laboratory Quality Assurance and Deliverables

The results of laboratory analyses are subject to the quality objectives of the Laboratory Quality Assurance Manual (QAM), which is available on request from the laboratory that is used to perform the analyses. The Laboratory QAM specifies methods for the maintenance and calibration of equipment, handling of samples, execution of test procedures, and other activities impacting the quality of the generated data.

Analytical results will be validated internally by the laboratory, according to laboratory procedures. The laboratory will assess the validity of sample results, along with duplicate, MS/MSD, and blank sample results. Laboratory validation is performed according to established internal quality control programs initiated by the laboratory.

Laboratory and field analytical results will be submitted in digital data files prepared in accordance with IDEM digital data format guidance. Hardcopy analytical reports will also be submitted.

Standard, or Level II, laboratory QA/QC reporting will be provided with the original analytical results. Level II laboratory data deliverables for performance monitoring samples will include:

- Date and time of sample receipt;
- Sample condition upon receipt;
- Sample identification number;
- Summary report of results (case narrative);
- Sampling, preparation and analysis data;
- Analytical and preparation methods used;
- Sample, duplicate sample, and blank results;
- Laboratory Control Sample results;
- MS/MSD results;
- Surrogate recoveries (for GC and GC/MS); and
- Signed chain of custody sheets for all samples.

In addition to the reporting elements listed above for Level II, Level III laboratory data deliverables will include summaries of:

- Instrument performance checks;
- Initial calibration data;
- Continuing calibration checks;
- Methods;
- Laboratory Control Samples;
- MS/MSD results;
- Surrogate recoveries;
- Internal standards;
- Retention times; and
- GC analytical sequence.

In accordance with the RCG, if the laboratory results will be used for closure purposes, the final laboratory report will include additional QA/QC documentation, including raw data. This laboratory reporting level, referred to as Level IV, will accompany the analytical results submitted if requested.

The Level IV (**Full Data Package**) report will also include raw data for:

- GC/MS tuning;
- Continuing Calibration standards;
- Initial Calibration curves;
- Method blanks;
- Laboratory Control Samples;
- MS/MSD samples;
- Sample Chromatograms and quantitative reports;
- GC/MS Spectra;
- Sample run logs; and

- Extraction logs.

4.7 Analytical Results

The data will be used to evaluate the soil and/or groundwater quality relative to the IDEM RCG screening levels. If analytical results are found above the closure concentrations, additional soil and groundwater assessment and/or remediation may be necessary.

5 Data Quality Assessment

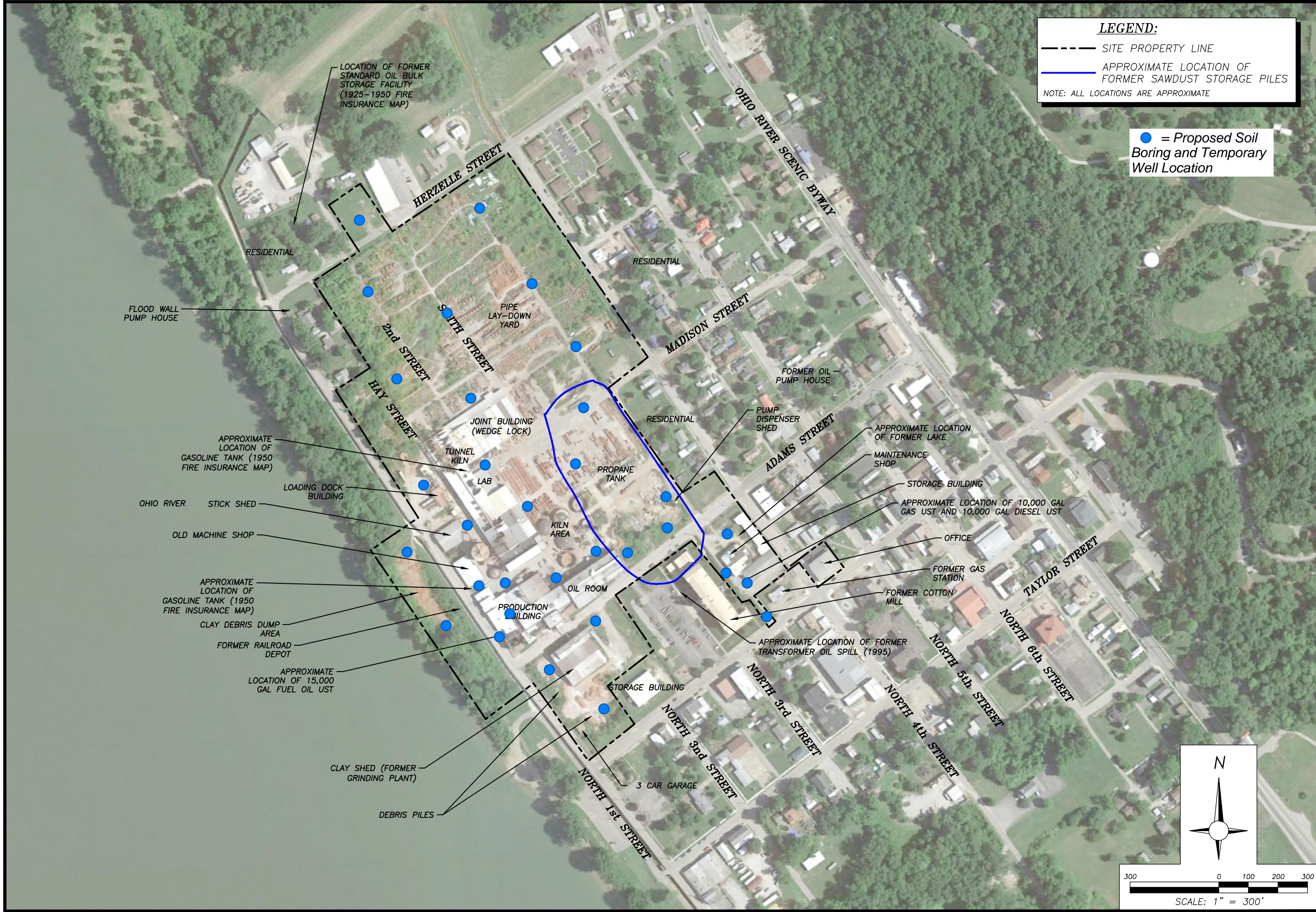
Data Quality Assessment (DQA) involves assessing the effectiveness of the sample design, sampling procedure, and laboratory analysis. DQA is used to ensure that the sampling and analytical quality are adequate to meet the PARCC requirements established in the DQOs. DQA identifies the review process needed to support project requirements and confirms that the field sampling QA/QC event, the field documentation, and the QA/QC samples provide useable data. DQA also evaluates the final results of the Site investigation and compares them to the closure levels. Accordingly, DQA of field and laboratory data collection will include the following:

- Review of sampling design and data collection documentation;
- Review of field measurement results;
- Review of laboratory case narratives;
- Review of field duplicate results;
- Review of equipment blank results; and
- Review of MS/MSD results and blank results.

Comparison of soil and groundwater concentrations to the IDEM RCG screening levels is part of the DQA process.

Figure 1 – Proposed Boring Locations

H:\2019\IN 15 REGIONAL PLANNING COMMISSION\CAN CLAY PROPERTY\ENVIRO\170IRPC08P-SITE.DWG, 11X17L



LEGEND:
--- SITE PROPERTY LINE
--- APPROXIMATE LOCATION OF FORMER SAWDUST STORAGE PILES
NOTE: ALL LOCATIONS ARE APPROXIMATE

● = Proposed Soil Boring and Temporary Well Location


Drn. By:	JG	Ckd. By:	BK	App'd By:		Ckd. Date:	
Project Number:	170IRPC08P	Drawing File:	SEE LOWER LEFT				
SITE PLAN CAN CLAY FACILITY 402 WASHINGTON STREET CANNELTON, INDIANA							
Date: 7/19 Scale: AS SHOWN Figure: 1							

Table 1 – Proposed Sampling Program

Table 1. Proposed Sampling Program, Can Clay Facility, Cannelton, Indiana

Area of Concern	Sample Matrix	Data Usage	Number of Borings	Number of Samples	Field Parameters	Laboratory Parameters	Analytical Method
North Portion of Site near Lay-Down Area	Soil	Investigate Soil Quality	7	14	Qualitative screening; PID	VOCs PAHs RCRA Metals	8260 8270SIM 6010B and 7470
	Groundwater	Evaluate groundwater quality	7	7	Qualitative screening; pH, Specific Conductance, ORP, DO, Temperature	VOCs PAHs RCRA Metals	8260 8270SIM 6010B and 7470
Near Former Bulk Oil Storage Facility	Soil	Investigate Soil Quality	1	2	Qualitative screening; PID	VOCs PAHs RCRA Metals	8260 8270SIM 6010B and 7470
	Groundwater	Evaluate groundwater quality	1	1	Qualitative screening; pH, Specific Conductance, ORP, DO, Temperature	VOCs PAHs RCRA Metals	8260 8270SIM 6010B and 7470
Near Former Auto Station and Gasoline Tank near Tunnel Kiln Building	Soil	Investigate Soil Quality	2	4	Qualitative screening; PID	VOCs PAHs RCRA Metals	8260 8270SIM 6010B and 7470
	Groundwater	Evaluate groundwater quality	2	2	Qualitative screening; pH, Specific Conductance, ORP, DO, Temperature	VOCs PAHs RCRA Metals	8260 8270SIM 6010B and 7470
Near Production Building	Soil	Investigate Soil Quality	5	10	Qualitative screening; PID	VOCs PAHs RCRA Metals	8260 8270SIM 6010B and 7470
	Groundwater	Evaluate groundwater quality	5	5	Qualitative screening; pH, Specific Conductance, ORP, DO, Temperature	VOCs PAHs RCRA Metals	8260 8270SIM 6010B and 7470
Southwest of Production Building near 15,000 gallon fuel oil UST	Soil	Investigate Soil Quality	1	2	Qualitative screening; PID	VOCs PAHs RCRA Metals	8260 8270SIM 6010B and 7470
	Groundwater	Evaluate groundwater quality	1	1	Qualitative screening; pH, Specific Conductance, ORP, DO, Temperature	VOCs PAHs RCRA Metals	8260 8270SIM 6010B and 7470

Table 1. Proposed Sampling Program, Can Clay Facility, Cannelton, Indiana

Area of Concern	Sample Matrix	Data Usage	Number of Borings	Number of Samples	Field Parameters	Laboratory Parameters	Analytical Method
Near Transformers and Former Pump Station (Adams and N. 4th Street)	Soil	Investigate Soil Quality	2	4	Qualitative screening; PID	VOCs PAHs RCRA Metals PCBs	8260 8270SIM 6010B and 7470 8082
	Groundwater	Evaluate groundwater quality	2	2	Qualitative screening; pH, Specific Conductance, ORP, DO, Temperature	VOCs PAHs RCRA Metals	8260 8270SIM 6010B and 7470
Central Portion of the Site	Soil	Investigate Soil Quality	4	8	Qualitative screening; PID	VOCs PAHs RCRA Metals	8260 8270SIM 6010B and 7470
	Groundwater	Evaluate groundwater quality	4	4	Qualitative screening; pH, Specific Conductance, ORP, DO, Temperature	VOCs PAHs RCRA Metals	8260 8270SIM 6010B and 7470
Old Machine Shop and Gasoline UST (1950 fire insurance map)	Soil	Investigate Soil Quality	1	2	Qualitative screening; PID	VOCs PAHs RCRA Metals	8260 8270SIM 6010B and 7470
	Groundwater	Evaluate groundwater quality	1	1	Qualitative screening; pH, Specific Conductance, ORP, DO, Temperature	VOCs PAHs RCRA Metals	8260 8270SIM 6010B and 7470
Clay Dump Area and Former Railroad Depot	Soil	Investigate Soil Quality	2	4	Qualitative screening; PID	VOCs PAHs RCRA Metals	8260 8270SIM 6010B and 7470
	Groundwater	Evaluate groundwater quality	2	2	Qualitative screening; pH, Specific Conductance, ORP, DO, Temperature	VOCs PAHs RCRA Metals	8260 8270SIM 6010B and 7470
Near Maintenance Shop, Storage Building, and Gasoline/Diesel UST	Soil	Investigate Soil Quality	4	8	Qualitative screening; PID	VOCs PAHs RCRA Metals PCBs	8260 8270SIM 6010B and 7470 8082
	Groundwater	Evaluate groundwater quality	4	4	Qualitative screening; pH, Specific Conductance, ORP, DO, Temperature	VOCs PAHs RCRA Metals	8260 8270SIM 6010B and 7470

Table 1. Proposed Sampling Program, Can Clay Facility, Cannelton, Indiana

Area of Concern	Sample Matrix	Data Usage	Number of Borings	Number of Samples	Field Parameters	Laboratory Parameters	Analytical Method
Clay Shed and Debris Piles on South End of the Site	Soil	Investigate Soil Quality	3	6	Qualitative screening; PID	VOCs PAHs RCRA Metals	8260 8270SIM 6010B and 7470
	Groundwater	Evaluate groundwater quality	3	3	Qualitative screening; pH, Specific Conductance, ORP, DO, Temperature	VOCs PAHs RCRA Metals	8260 8270SIM 6010B and 7470
Duplicate sample	Soil	Investigate Soil Quality	NA	4	Qualitative screening; PID	VOCs PAHs RCRA Metals	8260 8270SIM 6010B and 7470
	Groundwater	Evaluate groundwater quality	NA	2	Qualitative screening; pH, Specific Conductance, ORP, DO, Temperature	VOCs PAHs RCRA Metals	8260 8270SIM 6010B and 7470
Trip Blank	DI Water / Blank Terra		NA	5	-	VOCs	8260
Matrix Spike/Matrix Spike Duplicate Sample	Soil	Investigate Soil Quality	NA	4	Qualitative screening; PID	VOCs PAHs RCRA Metals	8260 8270SIM 6010B and 7470
	Groundwater	Evaluate groundwater quality	NA	2	Qualitative screening; pH, Specific Conductance, ORP, DO, Temperature	VOCs PAHs RCRA Metals	8260 8270SIM 6010B and 7470

Notes:

NA - Not Applicable / PID = Photoionization Detector

DO = Dissolved Oxygen / ORP = Oxidation Reduction Potential

Appendix A – Site Health and Safety Plan



HEALTH AND SAFETY PLAN

Prepared By:
ATC Group Services LLC
6149 Wedeking Avenue, Building D, Suite 2
Evansville, Indiana 47715



Prepared For:
INDIANA 15 REGIONAL PLANNING COMMISSION

CAN CLAY FACILITY
402 WASHINGTON STREET
EVANSVILLE, INDIANA 47520

ATC PROJECT NO. 170IRPC08P



**ATC
HEALTH AND SAFETY PLAN (HASP)
REVIEW AND APPROVAL**

CLIENT Indiana 15 Regional Planning Commission

PROJECT NUMBER: 170IRPC08P

SITE NAME: Can Clay Facility SITE LOCATION: Cannelton, IN

PROJECT DESCRIPTION: Conduct subsurface investigation, removal of USTs, including the collection of soil and groundwater samples

PREPARED BY: Brian Kleeman Senior Project Geologist DATE: 9-11-2019

Brian Kleeman
Project Manager



Signature

9/11/19
Date

Reviewer's Name

Signature

Date

This Health and Safety Plan (Plan) has been written for the use of ATC Group Services LLC (ATC) and its employees. It may also be used as a guidance document by properly trained and experienced ATC subcontractors. However, ATC does not guarantee the health or safety of any person entering this Site.

Due to the potential hazardous nature of this Site and the activity occurring thereon, it is not possible to discover, evaluate, and provide protection for all possible hazards which may be encountered. Strict adherence to the health and safety guidelines set forth herein will reduce, but not eliminate, the potential for injury at this Site. The health and safety guidelines in this Plan were prepared specifically for this Site and should not be used on any other Site without prior research by trained health and safety specialists.

ATC claims no responsibility for use of this Plan by others. The Plan is written for the specific Site conditions, purposes, dates, and personnel specified and must be amended if these conditions change.

TABLE OF CONTENTS

	<u>Page No.</u>
1.0 INTRODUCTION.....	
1.1 Scope and Applicability of the Site Health and Safety Plan	1-1
1.2 Historical Overview	1-1
1.3 Visitors.....	1-2
1.4 Subcontractor Activities	1-2
2.0 PROJECT ORGANIZATION	
2.1 Site Safety and Health Officer (SSHO).....	2-1
2.2 Site Manager	2-1
2.3 Project Manager (PM).....	2-1
2.4 Regional Safety Coordinator (RSC)	2-2
2.5 Project Field Team.....	2-2
3.0 TASK/OPERATION HEALTH AND SAFETY RISK ANALYSIS SUMMARY	
3.1 Job Safety Analysis	3-1
3.2 Health Analysis and Chemical Risk Assessment	3-1
3.3 Risks Associated with Drilling and Subsurface Activities	3-1
3.4 Noise Hazards and Control.....	3-3
3.5 Biological Hazards	3-3
4.0 AIR MONITORING AND PERSONAL PROTECTION EQUIPMENT.....	
4.1 Site Air Monitoring Requirements.....	4-1
4.2 Action Levels for Personal Protection Equipment.....	4-2
4.3 Levels of Protection	4-4
4.4 Respiratory Protection	4-5
5.0 MEDICAL SURVEILLANCE PROGRAM	
5.1 Employee Medical Examinations	5-1
5.2 Heat Stress Program	5-1
5.2.1 Training	5-1
5.2.2 Fluid Replacement	5-1
5.2.3 Acclimatization	5-1
5.2.4 Rest Breaks.....	5-1
5.2.5 Heat Stress Monitoring	5-1
5.3 Cold Stress Program.....	5-3
5.3.1 Training	5-3
5.3.2 Environmental Monitoring.....	5-3
5.3.3 Protective Clothing and Rest Breaks	5-3
5.3.4 Identification and Treatment of Cold Stress	5-3
6.0 SITE SECURITY AND CONTROL	
6.1 Work Zones	6-1
6.2 Buddy System.....	6-2
6.2 Site Communication.....	6-3
6.3 Roadway Work Zones.....	6-4

TABLE OF CONTENTS

	<u>Page No.</u>
7.0 DECONTAMINATION PROCEDURES	
7.1 Personnel Decontamination	7-1
7.2 Equipment Decontamination	7-1
7.3 Disposition of Decontamination Wastes	7-2
8.0 STANDARD OPERATING PROCEDURES	
8.1 Personnel Precautions	8-1
8.2 Operations	8-1
9.0 CONTINGENCY PLAN	
9.1 Medical Emergencies	9-1
9.2 Emergency Equipment	9-2
9.3 Flammable Conditions	9-2
9.4 Site Evacuation Conditions	9-2
9.5 Emergency Communication System	9-2
9.6 Emergency Response Follow-up	9-3
10.0 EMPLOYEE TRAINING	
10.1 Pre-Assignment and Annual Refresher Training	10-1
10.2 Site Supervisor's Training	10-1
10.3 Site Safety Training and Briefing Topics	10-1
10.4 Visitors	10-1

APPENDICES

APPENDIX A - Job Safety Analysis

APPENDIX B - NIOSH Pocket Guide's Specific Chemical Information Sheets and SDSs

APPENDIX C - List of Approved Amendments/Changes
Acknowledgement/Agreement Form
Visitors Log
Tailgate Safety Meeting Form
Air Quality Monitoring Record
Equipment Calibration Log
Checklist for Subsurface Clearance
Monthly Heavy Equipment Safety Inspection Checklist
Drill Rig Inspection Checklist

APPENDIX D - Excavating and Trenching

APPENDIX E - Lockout/Tagout Requirements and Procedures

EMERGENCY INFORMATION

Site Emergencies Call:

Ambulance **911**

Fire: **911**

Police: **911**

Nationwide Call Before You Dig **811**

Core Health Networks (24 hour First-Aid) **(855) 282-6331**

Poison Control Center: **(800) 222-1222**

National Response Center: **(800) 424-8802**

Spills: **Local USEPA Office** **(800)-621-8431**
 State Health Department **(800)-246-8909**
 State Environmental Agency **(800) 451-6027**

Hospital **Perry County Memorial Hospital**
 8885 Highway 37, Tell City, Indiana 47586
 (812) 547-7011

See attached map for directions
Approximate travel time is 10 minutes.

EMERGENCY ASSEMBLY LOCATION: South end near Front Street and Washington Street.

FIRST-AID MEASURES

In the event that personnel exhibit symptoms of exposure call COMP-CARE immediately in first-aid assessment process. The following procedures will be used:

Eye Contact: Flush eye immediately with copious amount of water for a minimum of 15 minutes. Repeat until irritation is eliminated and seek medical attention.

Skin Contact: Wash exposed area with soap and water for at least 15 minutes. If dermatitis or severe reddening occurs, seek medical attention.

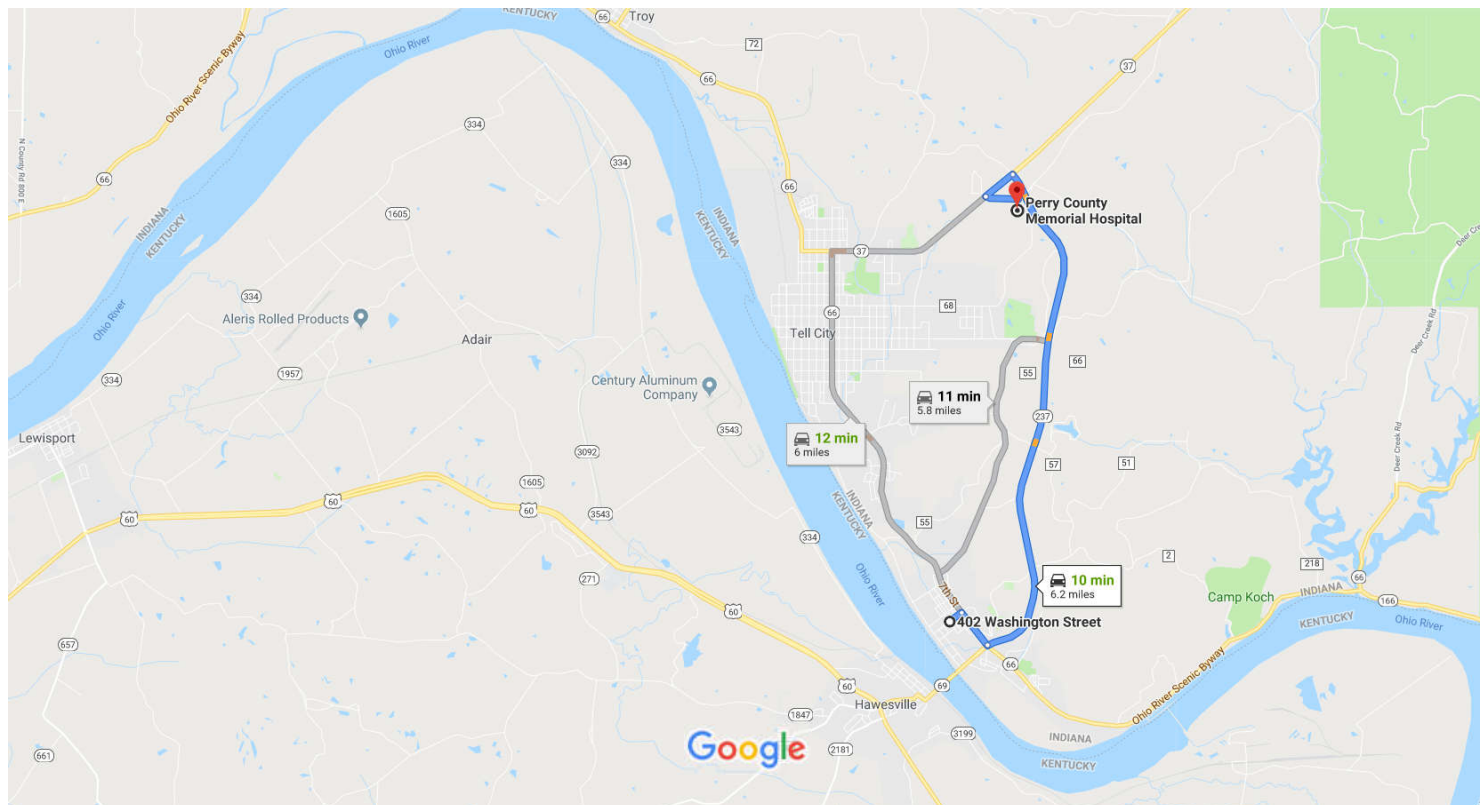
Inhalation: Move the person into fresh air. If symptoms persist, seek medical attention.
Ingestion: Do not induce vomiting. Seek immediate medical attention.

Important Numbers:

Project Manager:	Brian Kleeman	812-457-0043
Site Safety and Health Officer:	Brian Kleeman	812-457-0043
Site Supervisor:	Megan Foye	812-972-2425
Client Contact:	Nick Goodwin	812 367-8455
Regional Safety Coordinator:	Maria Rysavy	480-355-4657
State Utility Locate Service:	IUPPS	811

NOTE: For additional emergencies/important contacts, refer to your ATC Lifelines Card.

EMERGENCY MEDICAL ROUTE TO HOSPITAL



Map data ©2019 1 mi

402 Washington St

Cannelton, IN 47520

1. Head northeast on Washington St toward N 5th St
0.1 mi
2. Turn right onto 7th St/Ohio River Scenic Byway
[Continue to follow Ohio River Scenic Byway](#)
0.4 mi
3. Turn left onto IN-237 N
5.0 mi
4. Turn left onto IN-37 S
0.3 mi
5. Turn left onto Old State Rd 37
0.3 mi
6. Slight right onto Valley Tin Rd
79 ft

Perry County Memorial Hospital

8885 IN-237, Tell City, IN 47586

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to

1.0 - INTRODUCTION

1.1 Scope and Applicability of the Site Health and Safety Plan

This Health and Safety Plan (HASP) has been prepared by ATC Group Services LLC (ATC) for the activities associated with the subsurface investigation and UST closure at the Can Clay Facility, located at 402 Washington Street in Cannelton, Indiana (Site).

The health and safety protocols established in this Plan are based on the ATC Employee Health and Safety Policy Manual, the Occupational Safety and Health Administration (OSHA) Regulations, past field experiences, specific Site conditions, and chemical hazards known or anticipated to be present from available Site data. The following Site Health and Safety Plan (HASP) is intended solely for use during the proposed activities described in the project documents and technical specifications. Specifications herein are subject to review and revision based on actual conditions encountered in the field during Site characterization activities. Such changes may be instituted by using the HASP List of Approved Amendments and/or Changes (see Appendix C).

Before Site operations begin, all employees, including subcontractors for ATC covered by this plan, involved in these operations will have read and understood this HASP and all revisions. All Site personnel have the authority to "Stop Work" if unsafe conditions are present or discovered during Site activities. Before work begins, all affected workers will sign the Health and Safety Plan Acknowledgment Form (see Appendix C). By signing this form, all individuals recognize the requirements of the HASP, known or suspected hazards, and will adhere to the protocols required for the project Site.

1.2 Historical Overview

Based on the Phase I Environmental Site Assessment (ESA), dated August 6, 2019, ATC identified *recognized environmental conditions* (RECs) including the following:

- Past industrial uses, maintenance operations, and fueling operations associated with the property and/or surrounding properties represent a *recognized environmental condition*.
- The reported violations associated with stored sawdust debris and smoke emissions, and lack of closure documentation regarding the on-site and south adjacent USTs represent *recognized environmental conditions*.
- Stressed vegetation observed beneath on-site transformers represents a *recognized environmental condition*.
- Poor housekeeping associated with container storage and excessive staining in the facility buildings and exterior slab areas represents a *recognized environmental condition*.
- The observed miscellaneous debris across the property represents a *recognized environmental condition*.
- The black material observed in the pit areas beneath the production building represents a *recognized environmental condition*.

- The oily staining near the floor drains constitutes a potential release to the sewer system and subsurface, which represents a *recognized environmental condition*.
- The following potential subsurface vapor migration sources are considered to represent a *recognized environmental condition*.
 - Past use of fuel USTs on the property and south adjacent property and lack of closure documentation.
 - Past use of a fueling station, automotive repair shop, and maintenance garage on the property.
 - Past use of multiple solvents at the facility and observed staining/poor housekeeping.
 - Past use of a bulk oil storage facility on the north adjacent property.
 - Past use of a parts washer and hydraulic equipment in the production building.

The objective of the scope of work described in the SAP is to investigate the soil and groundwater quality as well as building materials for the presence of asbestos and lead-based paint. Once the Site is characterized and the environmental issues are resolved, the Site may be redeveloped.

1.3 Visitors

All visitors to the Site must be instructed about the hazards of the activities that ATC or its subcontractors are performing. All visitors must sign the ATC Visitors Log (see Appendix C).

1.4 Subcontractor Activities

All subcontractors used at the Site have been Pre-Approved in the ATC Subcontractor Prequalification System.

2.0 - PROJECT ORGANIZATION

All personnel and visitors who may enter work areas on this Site must comply with the requirements of this HASP. All Site personnel have the authority to “Stop Work” if unsafe conditions are present. The specific responsibilities and authority of management, safety and health, and other personnel on this Site are detailed in the following sections.

2.1 Site Safety and Health Officer (SSHO)

The Site Safety and Health Officer (SSHO) has the responsibility and authority to develop and implement this HASP and to verify compliance. The SSHO reports to the Project Manager. The SSHO is on-site during all work operations and has the responsibility to halt Site work if unsafe conditions are detected. The responsibilities of the SSHO at the Site include the following:

- Managing the health and safety functions on the Site;
- Ensuring Site monitoring, worker training, and effective selection and use of PPE;
- Conducting daily Tailgate Safety Meetings for Site personnel and subcontractors and summarize the training on the Tailgate Meeting Form (see Appendix C). The following topics should be covered during safety meetings:
 - Hazard Communication (i.e., MSDS location, and container labeling, chemical hazards of non-routine tasks)
 - Determine applicability of Standard Operating Procedures (SOP) in Section 8 and communicate procedures
 - Review Site safety requirements
 - Give refresher training on heat or cold stress (Section 5.2 and 5.3) when appropriate
 - Review Site emergency procedures
 - Discuss location and use of a rig kill switch for drilling/boring operations
- Conducting daily safety inspections of the Site looking for unsafe acts or conditions and providing corrective action as appropriate.

2.2 Site Supervisor

The Site Supervisor is responsible for field operations and reports to the Project Manager. The Site Supervisor is the On-site Coordinator and overseer of operations. It is the Site Supervisor's duty to maintain Site security, supervise the personnel on the Site, coordinate the activities of the subcontractor personnel, and check that the HASP is followed and modified when necessary. The Site Supervisor's specific responsibilities include:

- Executing the work plan and schedule as detailed by the Project Manager
- Coordination with the SSHO on health and safety issues
- Ensuring Site work compliance with the requirements of the HASP
- Before Site activities, contact the hospital emergency room, local fire department, and local police department, as applicable. If outside town, contact county officials and local emergency services.

2.3 Project Manager (PM)

The Project Manager (PM) has the primary responsibility for the fulfillment of the terms of the contract and overseeing operations for the purpose that includes meeting legal and safety

requirements. It is the PM's responsibility to keep the project on schedule, within budget, and communicate with the Client regarding the progress toward specified goals.

The PM will inform the Regional Safety Coordinator of all HASP modifications, violations, injuries, exposures, and near-miss situations. The PM responsibilities include:

- Provide personnel time to read and understand the Site Health and Safety Plan (HASP) before fieldwork.
- Conduct project start-up health and safety briefing for: Field personnel, the Site Supervisor, the project team.
- Check that each subcontractor is pre-approved and that each subcontractor's Site workers have appropriate HAZWOPER Training Certificates.
- Check that Site personnel, if required, have received Respiratory Protection Training, Fit testing, and physician's approval to wear a respirator.
- That hazards identified during any Site audits are corrected. If necessary for immediate hazards, shut down field operations if hazards can not be corrected or the hazards present an immediate threat to life and health.

2.4 Regional Safety Coordinator (RSC)

The Regional Safety Coordinator (RSC) is responsible for providing professional health and safety advice and oversight management to the project. The RSC will review and provide support for concerns regarding the health and safety of field personnel assigned to this project, including:

- If requested by the Project Manager, approval of Routine HASP;
- Approval of all Non-Routine HASP;
- Review of incident reports, inspections, and air monitoring results;
- When required, the RSC will conduct a field audit of the Site to evaluate the adequacy of the program and implement the necessary changes through the HASP.

2.5 Project Field Team

The Project Team includes technicians, engineers, scientists, geologists, and possibly subcontractors who perform field activities. Each individual team member will be responsible for understanding and personally complying with the HASP and Site health and safety requirements. Project Team members will report health and safety violations to either the Site Supervisor or the SSHO. Health and safety responsibilities, as discussed in this Plan, which are shared by all Site personnel include:

- Complying with the requirements of the HASP
- Reporting unsafe acts or conditions
- Retain copies at the Site of the following health and safety records:
 - Current HAZWOPER Training Certificate.
 - Respiratory Protection Training Certificate and current fit test record for potential respirator users.
 - Physician's approval for hazardous-waste fieldwork and/or respirator use.
 - First-aid/CPR and bloodborne pathogens training certificate.

3.0 – TASK/OPERATION HEALTH AND SAFETY RISK ANALYSIS SUMMARY

This chapter of the HASP describes the safety and health hazards associated with the Site work and control measures selected to protect workers. The purpose of the Job Safety Analysis (JSA) is to identify the routine safety and health hazards associated with the routine Site tasks and operations. Using this information, appropriate control methods are selected to eliminate the identified risks or effectively control them.

3.1 Job Safety Analysis (JSA)

Each specific JSA appears on a separate copy of the spreadsheets in Appendix A. A single JSA may be used for a task/operation performed in multiple locations if the hazards, potential exposures, and controls are the same at each location.

3.2 Health Analysis and Chemical Risk Assessment

Chemicals may be purchased and transported to the Site to support Site characterization and remediation operations. The principal chemical contaminants at the Site are expected to be petroleum, organic compounds, and metals. Appendix B contains information from the National Institute for Occupational Safety and Health (NIOSH) Pocket Guide to Chemical Hazards about each of these chemicals. Additionally, the Hazard Communication Program (Policy No. 21) requires ATC to provide employees, contractors, subcontractors, and visitors with information on the health effects of these chemicals and necessary actions to protect against exposure. This information is transmitted through Material Safety Data Sheets (MSDS), the NIOSH Pocket Guide, container labels, training, and a written Hazard Communication program.

Site activities will adhere to the ATC Hazard Communication Program as described in the Policy. All Site personnel, including subcontractors, will be briefed on this Program as part of the Site orientation training before starting work. In accordance with this Program, the PM and Site Supervisor will check that each chemical brought to the Site is accompanied by its MSDS. A copy of each MSDS will be made available to each Site employee who may be potentially exposed to the chemical. In addition, the Site Supervisor will check that all subcontractors bring at least one copy of MSDS for each chemical they bring onto the Site. The Site Supervisor will also check that all chemical containers brought to the Site to determine if they are labeled as to its contents and appropriate hazard warnings.

3.3 Risks Associated With Drilling and Subsurface Activities

Drilling operations will conform to the Job Safety Analysis and Subsurface Investigation (ATC Policy No. 33). During drilling and excavation operations, the subsurface is penetrated to obtain soil and/or groundwater samples. Contaminated soil cuttings and groundwater may be brought to the surface, creating a potential for exposure through skin contact and inhalation of vapors. The open borehole/excavation also creates a conduit for vapors to be released to the atmosphere. However, the amount of vapors released to the atmosphere is relatively small and vapors are usually quickly diluted and dispersed in air. Air monitoring is required to determine if protective equipment is necessary, as described in Section 4.0 of this HASP.

In addition to these chemical risks, the risk of drilling into a buried utility, such as a gas, water, electric line, or underground storage tank or other structures, is always present. Complete the Checklist for Subsurface Clearance prior to any subsurface work (see Appendix C) and follow the procedures in Table 3-1 for at least the first 5 feet of penetration:

TABLE 3-1
DRILLING/PROBING PROCEDURES
(First 5 feet below surface)

Step 1 - Site Walk	Conduct Site walk. Verify that the Checklist for Subsurface Clearance has been fully completed.
Step 2 - Locate Markouts	Locate all utility markouts and borehole locations. Start intrusive activities at least five (5) feet away and perpendicular to all marked utility lines.
Step 3 - Break Surface Cover	Use a jackhammer or concrete saw to break through the asphalt or concrete surface cover. The drill bit on the rig may also be used on the asphalt cover. Do NOT advance bit or cutting tools beyond the asphalt or concrete cover.
Step 4 - Surface Boring	<p>Use air knife with vacuum extractors, hand auger, or hand shovel to remove soil from the borehole to a depth of at least 5 feet below surface. The soil in the borehole should be excavated to a diameter of at least three inches greater than the diameter of the drill bit on the lead auger or drill stem that is to be used.</p> <p>If it is not possible to perform a surface boring which meets the diameter requirements as stated above, surface borings should be installed to the required depth of 5 feet surrounding the proposed well/boring location in such a manner that any lines/utilities passing through the proposed well/boring location will be encountered while installing the investigation borings/well.</p> <p>If pea gravel, fill material, or refusal is encountered, and was not expected to be encountered, abandon the boring and follow instructions from item #9 of section 5.4.1.</p>
Step 5 - Soil Sampling	If soil samples are required to be collected within the first 5 feet below surface, a hand auger should be utilized to collect native, undisturbed soil samples.
Step 6 - Borehole Protection	If no piping or other structures are encountered within the first 5 feet below surface, normal drill/probe activities may proceed with <u>caution</u> . Containerize drill cuttings as appropriate. If excavation of the borehole is conducted the day before actual drilling is conducted, the borehole should be covered with barricades or cones and with a sheet of material sufficient in strength to support a person's weight until it is ready to be drilled. If the borehole is of sufficient size to potentially cause damage to a vehicle if driven over, the borehole should be covered with a material sufficient in strength to support vehicular weight. In lieu of barricades or cones and a material cover, the boring may be temporarily backfilled to surface. If a backfill material is utilized, it is important for the material to be flush with the surrounding pavement.

Risks of injury associated with the drilling operation itself also exist. The risks of working near

overhead electrical lines may also present a safety hazard. The SSHO will check for the presence of overhead lines and other obstructions. No drilling operations will be performed within 10 feet of overhead lines with voltages 0-50 kV. For other voltages refer to ATC Electrical Safety Policy (No. 12) and Equipment (Drill Rigs, Mobile Equipment) Policy (No. 15).

Whenever possible, stay at least two feet from turning or rotating machinery. This includes augers, cathead, engine power takeoff, and drill rods. Learn where the rig kill switch is to shut the rig off in case of an emergency. A discussion should be held with the driller on each drill rig at the startup of the field work to discuss the location and use of the kill switch and for documentation of a Safety Inspection such as the Monthly Heavy Equipment Safety Inspection Checklist found in Appendix C.

3.4 Noise Hazards and Controls

Exposure to high levels of noise may occur when working near drill rigs or other heavy equipment. Also, depending upon where the work is being performed, local equipment (e.g., airports, factory machines, etc.) may produce high levels of noise. Employees exposed to noise levels in excess of the action level of 85 decibels (A-weighted, Slow Response) will be included into the ATC Policy on Hearing Conservation (Policy No. 34). The SSHO may evaluate employee noise exposures using a Noise Survey Meter or a Noise Dosimeter. The RSC may conduct additional noise monitoring to determine the appropriate response to be taken. Employees will be provided with ear plugs and/or earmuffs when exposed to noise levels in excess of the 8-hour Permissible Exposure Limit (PEL) of 90 decibel (A-weighted, Slow Response). This hearing protection shall have a Noise Reduction Rating (NRR) to protect hearing in accordance with Policy No. 34, including the NRR de-rating factor of $[(NRR-7)/2]$.

3.5 Biological Hazards

Site activities on this Site may expose workers to other hazards such as poisonous plants, insects, animals, and indigenous pathogens. Protective clothing and respiratory protection equipment, and being capable of identifying poisonous plants, animals, and insects, can greatly reduce the chances of exposure. Thoroughly washing any exposed body parts, clothing, and equipment will also protect against infections. If working in wooded/grassy areas, use appropriate insect repellants (containing DEET and/or Permethrin) and apply them per the manufacturers' directions.

Site activities may also expose workers to mold inside the Site structure(s). Protective clothing and respiratory protection may also be needed to limit any exposure of potential mold.

3.6 Building Material Hazards

Site activities may expose workers to hazards such as asbestos containing materials (ACMs), lead-based paint (LBP), and mold. The use of protective clothing (Tyvek materials) and respiratory protection equipment may become necessary when working with suspect ACMs, LBP, and mold on the site. Refer to Appendix C for the ATC Voluntary Respirator Use Form.

4.0 - AIR MONITORING AND PERSONAL PROTECTIVE EQUIPMENT

4.1 Site Air Monitoring Requirements

To prevent exposure to hazardous conditions and aid in the selection of personal protective equipment, monitoring for the presence of airborne contaminants will occur when knowledge of the Site indicates their potential presence. One or more of the following direct-reading instruments may be used to aid in this determination. Photoionization Detectors (PID) and Flame Ionization Detectors (FID) will measure non-specific organic gases and vapors. Combustible Gas Indicators (CGI) will detect explosive atmospheres. Oxygen (O₂) meters will detect fluctuations in oxygen concentrations. These instruments should be calibrated or bump tested daily and whenever the readings may be erratic. All readings should be recorded in the field log books.

Colorimetric detector tubes supplement PID and/or FID readings to measure specific gases and vapors. Other direct-reading instruments are available for use to monitor for the presence of specific airborne Site contaminants.

The breathing zone of the employee(s) anticipated to have the highest potential for exposure for each task will be monitored using an appropriate combination of some or all of these direct-reading instruments. Air monitoring will occur every 15 minutes during non-intrusive activities, or every 5 feet of penetration during intrusive activities. Site tasks and air monitoring requirements are shown in Table 4-1. Additional Site monitoring may occur at the discretion of the SSHO, Site Supervisor, or RSC.

NOTE: All air monitoring equipment must be calibrated as per manufacturer's instructions.

Table 4-1
Site Air Monitoring Requirements

Site Activity	Instrument	Frequency	Location	Caution
Drilling	PID	Every 15 minutes or 5 feet of penetration	In breathing zone of person nearest activity	Communicate with equipment operator before sampling
	CGI	Every 15 minutes or 5 feet of penetration	In work area near activity	Communicate with equipment operator before sampling
	Detector tubes	As indicated in Table 5-2 when exceed PID limits	In breathing zone of person nearest activity	Strong odors may require further testing.
Ground water sampling	PID	Every 15 minutes	In breathing zone of person nearest activity	Strongest likely concentration when opening cover
	CGI	Every 15 minutes	In work area near activity	Strongest likely concentration when opening cover

Site Activity	Instrument	Frequency	Location	Caution
	Detector tubes	Every 15 minutes	In breathing zone of person nearest activity	Strongest likely concentration when opening cover

Air monitoring results obtained from the breathing zone during field activities will be recorded in field logbooks and the Air Quality Monitoring Record (see Appendix C). All such records will also include the location, date/time, weather conditions, person monitored, background concentration, and identification of specific contaminant whenever possible. Air monitoring information will be utilized to evaluate personnel exposure and assess the appropriateness of PPE for Site conditions. The PPE for the Site are discussed in Section 4.2. Photoionization detector (PID), combustible gas indicator (CGI), and detector tube readings measured in the employees breathing zone will be used to determine the level of protection required. PID readings refer to readings above background, which are sustained for at least 5 minutes and are measured during the performance of field tasks. PID readings are used for general screening.

4.2 Action Levels for Personal Protection Equipment

The first and foremost means of protecting employees from injuries or exposures is to eliminate the exposure. The general hierarchy for controlling potential exposures is: (1) Engineering Controls; (2) Administrative Controls; and (3) the use of PPE. PPE is a means of preventing injury or exposure when exposure elimination and/or other control means are not feasible.

The initial level of protection and the Action Levels at which the PPE will be upgraded are determined based on the identification of specific chemicals expected to be present at a Site and the established OSHA Permissible Exposure Levels (PEL) or ACGIH Threshold Limit Values (TLVs), whichever is lower. In the event more than one chemical is expected or exists at a Site, the most hazardous chemical will dictate the level of personal protection required. Table 4-2 shows the action levels for levels of personal protection equipment.

Table 4-2
Action Levels for Personal Protection Equipment

Monitoring Equipment	Hazard	Action Level Above Background	Action
PID/FID	Organic gas/vapor	< 10 ppm	Level D.
		10 to 50 ppm	Level C. Move upwind and continue air monitoring, cease operations, or use detector tube(s) and reference Table 4-3 below.
		> 50 ppm	Immediate Withdrawal. Contact the PM and RSC for further instructions to proceed.

Detector tubes to be used are indicated for given ranges based upon the PID readings (Table 4-2). As appropriate, PID readings in conjunction with detector tubes will be utilized during the field activity and location anticipated having the highest level of contamination. This location will be selected by the Site Supervisor. If these measurements indicate exposure levels appropriate

for Level D work, the use of detector tubes will be limited to situations where field conditions or activities have changed. Detector tubes will be available for use at the discretion of the Site Supervisor and the SSHO.

If readings exceed the range for level of protection indicated, personnel should withdraw and not return until an appropriate level of protection has been donned. Upgrading protection shall be communicated to the SSHO, who will in turn convey this information to the RSC. Upon review of PID, CGI, and detector tube measurements, the RSC may further adjust the PPE requirements.

Any upgrading to higher levels of protection may require additional personal sampling using National Institute for Occupational Safety and Health (NIOSH) or Occupational Safety and Health Administration (OSHA) methods for the collection and analysis of airborne contaminants.

Air monitoring equipment used on the Site should be calibrated with the following:

Calibration/Response Check

<u>Types</u>	<u>Frequency</u>	<u>Gas Standard</u>
PID	Daily	100 ppm isobutylene in air
CGI	Daily	Pentane/Methane
Universal Test Pump- Sensidyne (refer to mfg. for other pumps)	Daily	Leak Test: Insert unbroken detector tube into orifice, pull and lock handle in sampling position, wait 15-30 sec. Slowly and carefully release the handle. If handle does not return to 1/8", pump leaks.

Field personnel, in conjunction with the Site Supervisor and SSHO, may choose to allow ventilation of vapors before resuming work (rather than using higher levels of PPE). If ventilation is conducted, additional air monitoring will be performed prior to the resumption of work to determine the level of PPE required.

4.3 Levels of Protection

Levels of protection for Site activities are described on the Site Air Monitoring Summary. The protection levels may include all or some of the following, based on work scope.

Level D:

- Work uniform – Long pants and shirt with sleeves (no tank tops) – refer to Policy No. 25 Personal Protective Equipment (Section 5.5)
- Disposable, inner nitrile gloves
- Chemical-resistant boots with steel toe
- Safety glasses with side shields
- High Visibility Reflective Vest Class 1, Class 2, or Class 3 (select based on Traffic speed)
- Hard hat
- Disposable, chemical-resistant outer boot covers*
- Hearing protection*

LEVEL C:

- Half-face or full-face, air purifying respirator (NIOSH approved)
 - Disposable, hooded, chemical-resistant clothing
 - Disposable, chemical-resistant outer gloves
 - Disposable, inner nitrile gloves
 - Chemical-resistant boots with steel toe
 - Disposable boot covers
 - Hard hat
 - Safety Glasses with side shields
 - High Visibility Reflective Vest Class 1, Class 2, or Class 3 (select based on Traffic speed)
 - Coveralls*
 - Hearing protection*
- (* Optional Equipment, depending on conditions/exposures)

4.4 Respiratory Protection

Respiratory protection requirements are described in detail in the ATC Respiratory Protection Program. Basic rules of respiratory usage are listed below:

- Facial hair that interferes with a satisfactory fit of the mask-to-face seal is not allowed on personnel required to wear respirators.
- Respirator cartridges should be replaced after approximately 8-hours of continuous or intermittent usage, unless otherwise noted. Cartridges should also be replaced if they become damaged, after the expiration date is exceeded, if vapor smell breakthrough occurs, or if filters become clogged causing resistance to breathing.
- Contact lenses may be worn when respiratory protection is required, in conjunction with additional eye protection to protect against particles or splashes, provided there is no interference with the respirator seal.
- Respirators shall be cleaned and disinfected after each day's use or more often, if necessary.
- Prior to donning, respirators will be inspected for worn or deteriorated parts. Emergency respirators or self-contained devices will be inspected at least once a month and after each use.
- After donning, personnel should perform a positive and negative user fit-check to determine if a good seal has been achieved.
- Each employee shall make sure that they have an annual respirator fit test and respiratory protection training.

5.0 - HEALTH SURVEILLANCE PROGRAM

5.1 Employee Medical Examinations

All employees involved in work at the Site will participate in ATC's Medical Surveillance Program administered by Health Resources. Additionally, when respirators are required (as determined by the SSHO and project manager), each employee will also have current respirator clearance.

A post project, follow-up exam may be required if an exposure incident is reported or an employee shows specific symptoms associated with the known or suspected hazardous chemicals. The RSC and the Project Manager will determine when post project exams are required.

5.2 Heat Stress Program

This procedure applies to all employees when heat stress conditions exist at project sites.

5.2.1 Training

The SSHO will have received acceptable training in first-aid and Cardiopulmonary Resuscitation (CPR), including training in heat-related illnesses. The SSHO shall also be trained on the requirements of the ATC Policy for Industrial Hygiene (Policy No. 23), which contains the requirement for Heat Stress monitoring. All workers should be capable of recognizing and treating the signs and symptoms of heat stress conditions. During potential heat stress conditions, ice should be readily available to rapidly cool victims.

5.2.2 Fluid Replacement

Water will be made available at the Site for employee fluid replacement. When heat stress is determined to be a problem by the SSHO, employees will be provided with balanced, electrolyte solutions to replace fluid and electrolyte loss. Employees will be provided with replacement fluids at a minimum rate of 8 ounces every 15 to 20 minutes per person.

5.2.3 Acclimatization

Acclimatization is a gradual physiological adaptation that improves an individual's ability to tolerate heat stress. Full-heat acclimatization requires up to 3 weeks of continued physical activity under heat-stress conditions similar to those anticipated for the work. Its loss begins when the work activity in the heat stress conditions is discontinued. A noticeable loss usually occurs within 3 – 4 days.

5.2.4 Rest Breaks

When heat stress conditions are applicable, all rest breaks should be taken out of the zone of exclusion into a cooler, shaded, rest area. If these conditions are not available, more frequent rest breaks will be taken.

5.2.5 Heat Stress Monitoring

Heat Stress and heat strain are conditions resulting from environmental factors including temperature, relative humidity, radiant heat transfer, and air movement, as they are affected by clothing. The primary objective of the heat stress management program is to prevent heat

stroke which is life threatening and the most serious of the heat-induced disabilities. Extra caution should be taken for workers who are not acclimated to working in the heat.

The following Heat Stress Index (refer to ATC Policy No. 23) should be used as a guide to evaluate heat stress situations. If the Heat Stress exceeds 105° F, contact the RSC prior to work for detailed guidance.

Heat Stress Index									
Temp. °F	Relative Humidity								
	10%	20%	30%	40%	50%	60%	70%	80%	90%
105	98	104	110	120	132				
102	97	101	108	117	125				
100	95	99	105	110	120	132			
98	93	97	101	106	110	125			
96	91	95	98	104	108	120	128		
94	89	93	95	100	105	111	122		
92	87	90	92	96	100	106	114	122	
90	85	88	90	92	96	100	106	114	122
88	82	86	87	89	93	95	100	106	115
86	80	84	85	87	90	92	96	100	109
84	78	81	83	85	86	89	91	95	99
82	77	79	80	81	84	86	89	91	95
80	75	77	78	79	81	83	85	86	89
78	72	75	77	78	79	80	81	83	85
76	70	72	75	76	77	77	77	78	79
74	68	70	73	74	75	75	75	76	77
NOTES: Add 10° F when protective clothing is being used; Add 10° F when in direct sunlight									

HSI Temp	Category	Injury Threat
Above 130° F	Extreme Danger	No work unless emergency exists. Contact ATC RSC and Corporate Risk Management Department prior to proceeding. Heat cramps or exhaustion likely, heat stroke possible if exposure is prolonged and there is physical activity.
105° to 130° F	Danger	Contact RSC prior to proceeding. Requires strict adherence to ACGIH Heat Stress Guidelines, including use of on-site WBGT equipment. Heat cramps or exhaustion likely, heat stroke possible if exposure is prolonged and there is physical activity.
90° to 105° F	Extreme Caution	Heat cramps or exhaustion likely, heat stroke possible if exposure is prolonged and there is physical activity.
80° to 90° F	Caution	Heat cramps or exhaustion likely, heat stroke possible if exposure is prolonged and there is physical activity.
Below 80° F	Normal Range	Typical conditions for time of year. Little or no danger under normal circumstances. As always, anticipate problems and work safely.

5.3 Cold Stress Program

This procedure applies to all employees who perform field work in cold environments at risk of cold stress injury and intended to protect workers from the most severe effects of cold stress.

5.3.1 Training

ATC Site employees have been trained in cold stress as part of their HAZWOPER 40-hour initial training. Site workers will receive refresher training by the SSHO in cold stress safety and health procedures. The training program will include, as a minimum, instruction in the following areas:

- Proper first-aid treatment
- Proper clothing practices
- Proper eating and drinking habits
- Recognition of impending frostbite
- Recognition of the signs and symptoms of impending hypothermia or excessive cooling of the body when shivering does not occur
- Safe working practices

The SSHO will be trained in first-aid, CPR, and cold stress conditions.

5.3.2 Environmental Monitoring

Frostbite and hypothermia are two types of cold injury that personnel must be protected against during the performance of field duties. The objective is to prevent the deep body temperature from falling below

96.8° F and to prevent cold injury to body extremities. Two factors influence the development of a cold injury the ambient temperature, and wind velocity.

The SSHO will monitor environmental conditions by recording ambient temperature and estimated wind-speed. Information contained in Tables 5-1 and 5-2 will be used to evaluate the possibility of hypothermia among workers on-site.

5.3.3 Protective Clothing and Rest Breaks

Use appropriate cold weather clothing when temperatures are at or below 40°F as exposed skin surfaces must be protected. These protective items can include facemask, hand wear, and foot wear. Workers handling evaporative solvents during cold stress conditions will take special precautions to avoid soaking gloves and clothing because of the added danger of prolonged skin contact and evaporative cooling. Personnel will wear protective clothing appropriate for the level of cold and planned physical activity. The objective is to protect all parts of the body, with emphasis on the hands and feet. Eye protection against glare and ultraviolet light should be worn in snowy and icy conditions.

The work rate should not be so great as to cause heavy sweating that could result in wet clothing. If heavy work must be done, opportunities for rest breaks will be provided where workers have the opportunity to change into dry clothing. Conversely, plan work activities to minimize time spent sitting or standing still. Rest breaks should be taken in a warm, dry area. Windbreaks can also be used to shield the work area from the cooling effects of wind.

5.3.4 Identification and Treatment of Cold Stress

When frostbite, hypothermia, or other cold stress symptoms are suspected, treat the patient to relieve symptoms or transport them to the medical facility identified on page TC-4.

TABLE 5-1
Threshold Limit Values Work/Warm-up Schedule
for Four-Hour Shift*

Air-Temperature--Sunny Sky		No Noticeable Wind		5 mph Wind		10 mph Wind		15 mph Wind		20 mph Wind	
°C (approx.)	°F (approx.)	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks
-26° to -28°	-15° to -19°	(Norm. Breaks) 1		(Norm. Breaks) 1		75 min	2	55 min	3	40 min	4
-29° to -31°	-20° to -24°	(Norm. Breaks) 1		75 min	2	55 min	3	40 min	4	30 min	5
-32° to -34°	-25° to -29°	75 min	2	55 min	3	40 min	4	30 min	5	Non-emergency work should cease	
-35° to -37°	-30° to -34°	55 min	3	40 min	4	30 min	5	Non-emergency work should cease		Non-emergency work should cease	
-38° to -39°	-35° to -39°	40 min	4	30 min	5	Non-emergency work should cease		Non-emergency work should cease		Non-emergency work should cease	
-40° to -42°	-40° to -44°	30 min	5	Non-emergency work should cease		Non-emergency work should cease		Non-emergency work should cease		Non-emergency work should cease	
-43° & below	-45° & below	Non-emergency work should cease		Non-emergency work should cease		Non-emergency work should cease		Non-emergency work should cease		Non-emergency work should cease	

- *1. Schedule applies to any 4-hour work period with moderate to heavy work activity, with warm-up periods of ten. (10) Minutes in a warm location and with an extended break (e.g., lunch) at the end of the 4-hour work period in a warm location. For Light-to-Moderate Work (limited physical movement): apply the schedule on step lower. For example, at -35°C (-30°F) with no noticeable wind (Step 4), a worker at a job with little physical movement should have a maximum work period of 40 minutes with 4 breaks in a 4-hour period (Step 5).
2. The following is suggested as a guide for estimating wind velocity if accurate information is not available: 5 mph: light flag moves; 10 mph: light flag fully extended; 15 mph: raises a newspaper sheet; 20 mph: blowing and drifting snow.
3. If only the wind chill cooling rate is available, a rough rule of thumb for applying it rather than the temperature and wind velocity factors given above would be 1) special warm-up breaks should be initiated at a wind chill cooling rate of about 1750 watts per square meter (W/m²); 2) all non-emergency work should have ceased at or before a wind chill of 2250 W/m². In general, the warm-up schedule provided above slightly under-compensates for the wind at the warmer temperatures, assuming acclimatization and clothing appropriate for winter work. On the other hand, the chart slightly overcompensates for the actual temperatures in the cooler ranges because windy conditions rarely prevail at extremely low temperatures.
4. TLVs apply only for workers in dry clothing.

* Adapted from Occupational Health & Safety Division, Saskatchewan Department of Labor.

TABLE 5-2
Cooling Power of Wind on Exposed Flesh Expressed as
Equivalent Temperature (under calm conditions)*

Estimated Wind Speed (mph)	Actual Temperature Reading (degrees F)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent chill Temperature (degrees F)											
calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds > 40 mph have little additional effect)	LITTLE DANGER If < hr with dry skin. Maximum danger of false sense of security				INCREASING DANGER Danger from freezing of exposed flesh within one minute.			GREAT DANGER Flesh may freeze within 30 seconds.				
	Trench foot and immersion foot may occur at any point on this chart.											

* Developed by U.S. Army Research Institute of Environmental Medicine, Natick, MA

6.0 - SITE SECURITY AND CONTROL

6.1 Work Zones

Restricted Site areas will include, but not necessarily be limited to, the following zones:

- **Exclusion Zone or Hot Zone** - any area where contamination is either known or likely to be present in concentrations that could pose a threat to human health and safety or that potential for harm to personnel exists because of the type of work activities being conducted. Appropriate PPE and warning signs should be utilized in this area.
- **Contamination Reduction Zone** - any area where workers conduct personal and equipment decontamination.
- **Support Zone** - areas where access is controlled, but the chance to encounter hazardous materials or conditions are minimal.

Access to the work zones will be controlled by work zone delineators (e.g. traffic cones, flags, vehicles, DOT approved devices, temporary or permanent fencing, and/or safety barrier tape). Figure 6-1 is an example of a work zone. Additionally, ATC employees should follow the requirements of the Employee Health and Safety Policy Manual, Policy No. 36, Work Zones in Traffic Areas for additional information.

In the event on-site personnel must upgrade their personal protective equipment, the work zones may require substantial modification in order to provide for the safety of nearby personnel not associated with this work. Any upgrade level will be communicated by the Site Supervisor to the PM. The PM will then inform the RSC of this occurrence.

6.2 Buddy System

The Buddy System will be used at all times by field personnel in the Exclusion Zones. The Buddy System means that personnel work in pairs and stay in close visual contact to be able to observe one another and summon rapid assistance in case of emergency. No one is to perform fieldwork alone without the approval of the Branch Safety Officer and/or the Regional Safety Officer.

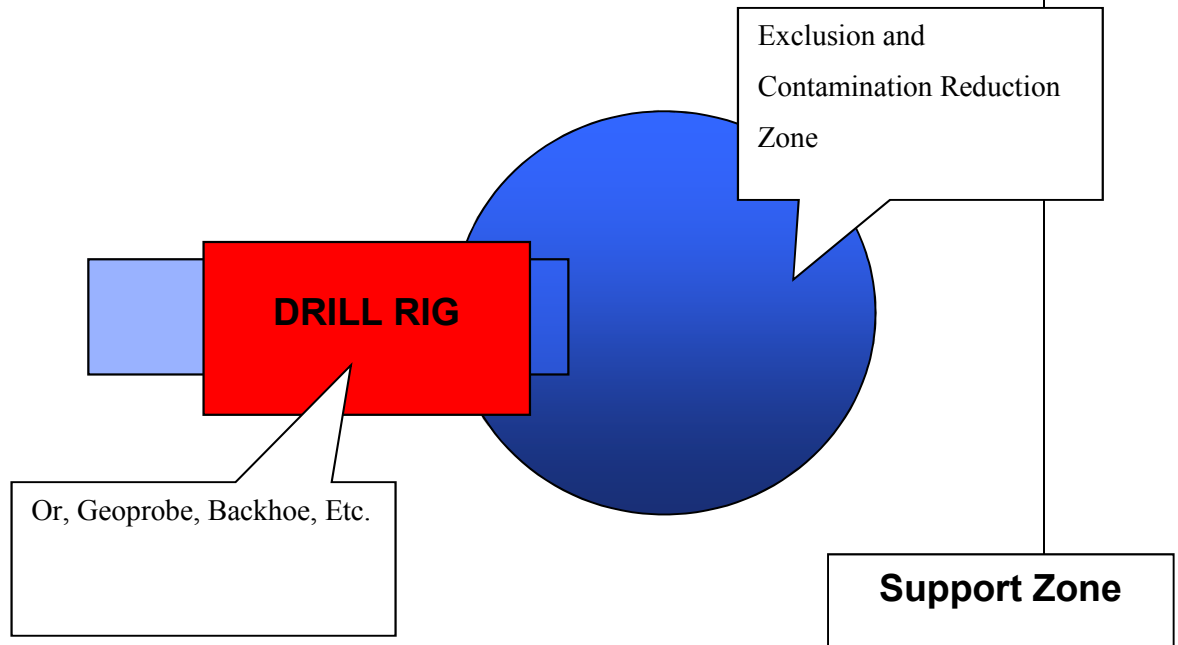
6.3 Site Communication

A loud and clear form of communication should be made available for Site personnel entering the work zones. Site communication may be in the form of hand signals, voice, or other communication devices. All forms of communication should be understood by all workers on the Site prior to starting work.

6.4 Roadway Work Zones

When ATC employee and subcontractors are required to perform Site operation in a city street or public right-of-way, a Traffic Control Plan may be required and included with this HASP. Check with the State or local government Department of Transportation for when a traffic control plan is required. Traffic Control Plans will include Transition Areas, Activity Areas, and Termination Areas.

FIGURE 6-1
TYPICAL EXCLUSION ZONE



7.0 - DECONTAMINATION PROCEDURES

7.1 Personnel Decontamination

All personnel must complete appropriate decontamination procedures in a way that is responsive to actual Site conditions before leaving the Site. The decontamination of personnel and equipment will be performed within the exclusion and contamination reduction zones. Wash tubs containing an appropriate decon solution and soft bristle brushes will be used to decontaminate personal protective clothing and boots. Deionized water will be used for the final rinse. The SSHO will visually inspect all PPE and other equipment once decontamination procedures are completed. In general, the four types of decontamination solutions to be considered for PPE include:

- Water for removal of low-molecular weight hydrocarbons, inorganic compounds, salts, some organic acids, and other polar compounds.
- Dilute acids (vinegar) for removal of basic (caustic) compounds, amines, and hydrazines.
- Dilute bases (soaps and detergents) for removal of acidic compounds, phenols, thiols, and some nitro and sulfonic compounds.
- Organic solvents for removal of nonpolar compounds (organic).

LEVEL D/LEVEL C

- Establish a segregated equipment drop
- Remove disposable, outer boot covers, if applicable
- Remove chemical resistant, outer gloves, if applicable
- Remove hard hat and goggles, safety glasses, or face shield
- Remove disposable, inner gloves
- Remove full-face air purifying respirator (Level C only)

Each individual will be responsible for inspecting and decontaminating their own respirator in accordance with the ATC Respiratory Protection Program (Policy No. 27).

At a minimum the hands and face of each employee must be thoroughly washed upon leaving the work area. Trash receptacles will be provided for all disposable clothing. Commercial laundries or cleaning establishments that decontaminate clothing or equipment will be informed of the potentially harmful effects of exposure.

7.2 Equipment Decontamination

The subcontractor will decontaminate field equipment according to the work plan. This may include manual removal of gross contamination with shovels or other tools, followed by a high-pressure, hot water sprayer. Because decontamination at the high-pressure, hot water station poses the possibility of a splash and/or mist inhalation hazard, the task should be performed using Level D personal protective equipment at a minimum.

Field tool including split-barrel soil samplers, brass liners, and sample knives and trowels will be decontaminated. The field tools may be scrubbed visually clean using a detergent solution

(Alconox/Liquinox) with water and a stiff, long-bristled scrub brush. Following the solution scrubbing, the tools may be rinsed with distilled water or isopropyl alcohol.

7.3 Disposition of Decontamination Wastes

All materials and equipment used for decontamination should be disposed of in accordance with local, State, and/or Federal Regulations. Clothing, tools, buckets, brushes, and all other equipment that is contaminated must be properly packaged and stored on the Site until disposal arrangements are finalized. Clothing not completely decontaminated on-site should be secured in plastic bags before being removed from the Site.

8.0 - STANDARD OPERATING PROCEDURES

The following Standard Operating Procedures (SOPs) will be applied to each location and activity where work is performed on a hazardous chemical site. As hazards increase or decrease on the Site, the applicability of each SOP must be determined by the SSHO with the approval of any changes by the Project Manager or the RSC.

8.1 Personnel Precautions

1. Eating, drinking, chewing gum or tobacco, smoking, and any practice that increases the probability of hand-to-mouth transfer and ingestion of material is prohibited in the exclusion and contamination reduction zone or in any area known to be contaminated.
2. When decontamination procedures for outer garments are in effect, the entire body should be thoroughly washed as soon as possible after the protective garment is removed.
3. Contact with contaminated or suspected contaminated surfaces should be avoided. When possible, do not walk through puddles, leachate, or discolored surfaces; kneel on the ground; or lean, sit, or place equipment on drums, containers, or the ground.
4. Medicines and alcohol can increase the effects from exposure to toxic chemicals. Personnel should not take prescribed drugs at hazardous waste operations where the potential for absorption, inhalation, or ingestion of toxic substances exists unless specifically approved by a qualified physician. Alcoholic beverage intake should be minimized or avoided.
5. All personnel must be familiar with Standard Operating Procedures and any additional instructions and information contained in this HASP. All visitors and subcontractors will read the HASP before entering the Site.
6. All personnel will be aware of symptoms for heat or cold stress.
7. All personnel will be familiar with the chemicals used on-site and the associated hazards as described in each respective MSDS. The MSDS for the chemicals on-site will be available and located in the company vehicle.

8.2 Operations

1. All personnel going to the Site must be adequately trained and thoroughly briefed on anticipated hazards, equipment, safety practices, emergency procedures, and communications.
2. Personnel on the Site must use the Buddy System when engaged in Level C work as specified in ATC Policy No. 35 (Hazwoper). The purpose of the Buddy System is to provide rapid assistance to employees in the event of an emergency.
3. Visual contact must be maintained between pairs of Site and safety personnel. Entry team members should remain close to assist each other during emergencies.

4. Personnel should practice unfamiliar operations before the actual procedure.
5. Entrance and exit locations must be designated, and emergency escape routes delineated. Warning signals for Site evacuation must be established by the SSHO before field activities.
6. Communications using radios, hand signals, or other means, must be maintained between initial entry members at all times. Emergency communications should be prearranged in case of radio failure, the necessity for evacuating the Site, or other reasons.
7. Wind indicators visible to all personnel should be strategically located throughout the Site.
8. Personnel and equipment in the contaminated area should be minimized, consistent with effective Site operations.
9. Work areas for various operational activities will be established.
10. Procedures for leaving a contaminated area will be planned and implemented before going to the Site. Work areas and decontamination procedures will be established based on expected Site conditions.
11. Frequent and regular inspections of Site operations will be conducted by the SSHO to check compliance with this HASP. If changes in operation occur, the HASP must be modified to reflect these changes.
12. All electrical equipment (power tools, extension cords, instruments, radios, etc.) will conform with ATC Policy No. 12 (Electrical) The SSHO will ensure that electrical equipment is free from recognized hazards that may cause physical harm to employees.
13. Fire prevention and protection (appropriate signs for flammable liquids, smoking areas, storage areas of combustible or flammable materials, etc.) will be according to ATC Policy No. 18, Fire Protection.
14. Site Tailgate Safety Meetings will be held daily to discuss anticipated Site conditions and daily activities. This meeting will be summarized in field logbooks and the Tailgate Safety Meeting Form (see Appendix C).

9.0 - CONTINGENCY PLAN

This chapter of the HASP describes potential emergencies at this Site and the procedures for responding to those emergencies.

9.1 Medical Emergencies

1. The name, address, telephone number, travel distance, and travel time to the nearest medical treatment facility are found in the Emergency Information section (see Page TC-4) of this HASP. A map and direction for locating the facility is available in the Emergency Information section (see Page TC-6) of this HASP.
2. Emergency routes will be verified and driven before any Site activities. It may be quicker to transport a person with minor injuries than to wait for Emergency Medical Services (EMS) to respond. Check with the local authorities for response times. Life threatening emergency situations will only be handled by emergency medical services.
3. Before mobilization on-site, the Site Supervisor will contact the local hospital emergency room personnel, local fire department, and local police department to brief them regarding the scope and hazards associated with the scheduled fieldwork. If the Site is outside an established town, contact will be made with county officials and local emergency services.
4. An emergency first-aid kit with contents per ATC Policy No. 20 (First-Aid) will be readily available on the Site, and personnel will have first-aid training. The first-aid kit also contains equipment necessary to protect first-aid providers against exposure to bloodborne pathogens. All first-aid providers will have received Bloodborne Pathogens training and can receive Hepatitis B vaccinations according to the ATC Policy No. 09 (Bloodborne Pathogens) if exposed to bodily fluids.
5. Any person who becomes ill or injured in the exclusion zone must be decontaminated as well as possible with consideration to which risk will be greater, the spread of contamination or the health of the individual. If the injury or illness is minor, full decontamination (remove contaminated clothing and wash hands and face with soap and water, See Section 7.0) should be completed and first-aid administered before transport. If the patient's condition is serious, at least partial decontamination should be completed (i.e., complete disrobing of the victim and redressing in clean coveralls or wrapping in a blanket). First-aid should be administered while awaiting an ambulance or paramedics.
6. The following steps should be followed if an injury or illness case occurs:
 - Check the Scene.
 - If safe to do so, check the condition of the injured.
 - Call 911 if the victim is unconscious or your training dictates to do so.
 - Care for the injured. Always use "Universal Precautions".
 - Call COMP-CARE (800) 756-1130, if the injury is non-life threatening. COMP-CARE will assist you with the location of the nearest clinic, if referral is needed.

7. Provisions must be made to identify the substance to which the worker has been exposed. This information must be given to medical personnel.

9.2 Emergency Equipment

1. A personal eyewash unit that meets ANSI Z358.1-1998, Section 6 will be available in each ATC field vehicle at the Site if corrosive chemicals (chemicals with a pH of <3 or >11) will be on-site.
2. An emergency first-aid kit with contents as per ATC Policy No. 20 (First-Aid). The Site Supervisor shall be trained and certified in first-aid and CPR.
3. An emergency spill cleanup kit will be available at the Site at all times. Unplanned releases will be reported to the SSHO and/or Site Supervisor as soon as possible.
4. Sufficient water and/or multipurpose dry chemical (Class A, B, and C) fire extinguishers, rated not less than 2A:10B:C, will be maintained on the Site to cope with any situation until emergency services arrive.

9.3 Flammable Conditions

In the event that combustible vapors exceed 10 percent of the LEL or strong odors are detected in the borehole, the following actions should be taken:

- Continue investigation using extreme caution. Personal protective equipment may need to be upgraded.
- Allow vapors to dissipate or use intrinsically-safe mechanical ventilation.
- If atmospheric conditions do not change, call in the listed sequence:
 - Project Manager
 - Regional Safety Coordinator
 - Fire Department
- Provide answering personnel with the call back numbers, locations, directions, and situation assessment.

9.4 Site Evacuation Conditions

The following conditions will necessitate the cessation of field work in the area of concern, withdrawal from the work area, and revisions to this HASP:

- Fires and/or explosions
- Unexploded ordnance is detected
- A major incident or injury occurs
- Flammable atmosphere readings above 10 percent LEL
- Oxygen readings above 23.5 percent oxygen concentration
- Oxygen readings at or below 19.5 percent oxygen concentration
- PID readings over 50 ppm sustained for more than 5 minutes
- Detector tube readings over the maximum Action Level for the contaminant specified

9.5 Emergency Communication System

Emergency contacts and telephone numbers are provided at the beginning of this HASP. Field crews will have some communication device at each active work location. These may include radios, mobile telephones, or walkie-talkies. Such communication devices will have sufficient range to contact the field office and/or emergency services. If an emergency occurs on-site, the Site Supervisor is responsible for checking that appropriate emergency contact has been notified. At the time of the emergency response, the Site Supervisor or designee will brief the emergency personnel on the status of the emergency, including Site conditions.

Field personnel will use hand signals if there are noisy working conditions on the Site. The hand signals that will be used are shown below and will be reviewed by the SSHO during the on-site safety briefing.

Signal	Meaning
Hands on top of head	Need assistance
Grip partner's wrist or place both hands around partner's arm	Leave area immediately
Thumbs up	OK; I am all right
Thumbs down	No; Negative
Hand gripping throat	Cannot breathe; Out of air

9.6 Emergency Response Follow-Up

If there is an incident, near-miss, or emergency response, the SSHO will notify the Project Manager and Regional Safety Coordinator. The Project Manager or the Branch Safety Officer will complete a Supervisor's Investigation Report (SIR) (Policy No. 51; Appendix 51-1) and submit to the appropriate Regional distribution list. Prior to resuming work, a Site safety meeting should be held to discuss the circumstances surrounding the incident and what should be done to prevent a re-occurrence.

10.0 - EMPLOYEE TRAINING

10.1 Pre-Assignment and Annual Refresher Training

All ATC Employees and Subcontractors will participate in routine health and safety education and training programs. These programs are designed to provide employees with a thorough knowledge of hazardous materials, health and safety hazard potential, and Federal Occupational Safety and Health Administration (OSHA) requirements published in 29 Code of Federal Regulations (CFR) Part 1910. According to 29 CFR 1910.120(e), Site employees will have received 40 hours of initial Hazardous Waste Operations & Emergency Response (HAZWOPER) instruction and 24 hours of supervised field experience. Attending an annual 8-hour HAZWOPER refresher training session maintains this initial training. It is the responsibility of the Project Manager and each subcontractor's supervising manager to determine if the subcontractor staff meets these training requirements.

10.2 Site Supervisor's Training

On-site Managers and Supervisors on hazardous waste sites who are directly responsible for or who supervise workers engaged in hazardous wastes operations receive, in addition to the initial 40 HAZWOPER training, 8 additional hours of specialized supervisory training in compliance with the OSHA regulations. This training includes training on the employer's safety and health program and the associated employee training program, personal protective equipment program, spill containment program, and health hazards monitoring procedure and techniques.

10.3 Site Safety Training and Briefing Topics

The SSHO will conduct Site-specific health and safety briefing for field personnel before the start of all field work. Briefing attendees will include the Site Supervisor, the Project Team, and Subcontractor personnel. At the conclusion of the meeting, personnel are to sign the HASP Agreement and Acknowledgement Form in the Appendices. As additional people are assigned to the Site, it is the responsibility of the SHSO to ensure that new personnel are briefed on health and safety protocols and ensure that they have reviewed and signed the HASP Agreement and Acknowledgement Form. Items to be covered include:

- Site-specific health and safety rules
- Client-specific health and safety rules
- Health effects of various chemicals used on the Site
- Emergency response actions pertaining to operations on-Site

Additionally, daily Site Tailgate Safety Meetings will be conducted to review past activities, plan ahead for new or changed operations, to understand any near-miss and "lessons learned, establish safe working procedures for anticipated hazards, and provide pertinent safety and health training and motivation. The SSHO will complete the Tailgate Safety Meeting Form located in the Appendices.

10.4 Visitors

All visitors entering the designated work zones will be subject to all applicable health and safety requirements during field operations at the Site. All visitors to a work Site will be given the opportunity to review the HASP, will be escorted at all times, and will be required to stay a safe distance from Site activities. The Site Supervisor and/or the SSHO will be responsible for briefing all visitors on the Site hazards, Site safety precautions, and the Site emergency response plan.

APPENDIX A

Job Safety Analysis (JSA)

JOB SAFETY ANALYSIS

COMPANY/PROJECT NAME or ID/LOCATION (City, State)		Rev. No.:	<input type="checkbox"/> NEW	2 PAGES
		9	<input checked="" type="checkbox"/> REVISED as of 1/24/2013	
WORK ACTIVITY: Hand Auger Excavation Covers the hazards with completing excavation using a hand auger.				
Equipment: Hand Auger, Extension Rods, Sand Trap, Shovel, Hammer, 5-Gallon Buckets, Bristle Brush, DOT Drum, Drum Dolly				
DEVELOPMENT TEAM		REVIEWED BY		
Aaron Ulishney	Project Geologist	Steve Marie	Project Manager	
Jonathan Love	Staff Geologist	Peter Petro	Health & Safety Manager	
MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (SEE CRITICAL ACTIONS FOR TASK-SPECIFIC REQUIREMENTS)				
<input checked="" type="checkbox"/> REFLECTIVE VEST <input checked="" type="checkbox"/> HARD HAT <input type="checkbox"/> LIFELINE/HARNESS <input checked="" type="checkbox"/> SAFETY GLASSES (ANSI Z87.1)	<input type="checkbox"/> GOGGLES on hard hat <input type="checkbox"/> FACE SHIELD <input type="checkbox"/> HEARING PROTECTION <input checked="" type="checkbox"/> SAFETY SHOES	<input type="checkbox"/> AIR PURIFYING <input type="checkbox"/> RESPIRATOR (Keep in Vehicle) <input type="checkbox"/> SUPPLIED RESPIRATOR <input checked="" type="checkbox"/> PPE CLOTHING: FRC Clothing	<input checked="" type="checkbox"/> GLOVES (Nitrile over Cut Resistant Level 3) <input type="checkbox"/> OTHER:	
JOB STEPS		POTENTIAL HAZARDS		CRITICAL ACTIONS TO MITIGATE HAZARDS
1. Hand Auger Excavation Set Up	<ul style="list-style-type: none"> Injury from / Damage to Underground Utilities and/or Structures - resulting in fire, explosion, release of water, electrocution 		<ul style="list-style-type: none"> Contact utility locator service (USA Alert) at least 48 hours before onset of fieldwork. Follow ExxonMobil Subsurface Clearance and Excavation Permit procedures. - advance probe before augering (CSE2) Do not force hand auger. If refusal, call PM to discuss potential subsurface obstructions. 	
2. Hang Auger	<ul style="list-style-type: none"> Injury to hands 		<ul style="list-style-type: none"> Wear cut resistant gloves at all times when handling tools/equipment. (CSE5) 	
	<ul style="list-style-type: none"> Muscle strain / overexertion from hand auger operation 		<ul style="list-style-type: none"> Inspect for broken welds, metal spurs on connections, do not use if damaged. Do not use excessive force or cheater bar that can cause injury, choose alternate tool to loosen soil or step out with PM approval. Take breaks based on heat stress appendix in SSP (to include drinking fluids to stay hydrated) Rotate personnel performing hand augering once per hour. Do not turn at waist, turn with arms and shoulders, keep feet square and lift with legs. 	
	<ul style="list-style-type: none"> Injury from tripping/slipping - resulting in broken bones, torn ligaments and tendons 		<ul style="list-style-type: none"> Walking is working, focus on path avoid uneven ground and slopes when walking. Plan path which provides least number of obstacles. Use shovel to level ground to create flat working surface. Keep tools/equipment in designated area away from work area/borehole. 	
	<ul style="list-style-type: none"> Hitting people or stationary objects with T handle / extension rods 		<ul style="list-style-type: none"> Be aware of hazards when hand auger is at full extension and maintain clear communication with co-workers. Utilize two personnel to remove auger from hole when >10 ft. in length Look up and watch the T handle while lowering auger into the hole, to avoid hitting yourself with the T handle 	
3. Emptying Soil from Hand Auger Bucket	<ul style="list-style-type: none"> Pinch points / strike hazards / cut hazards 		<ul style="list-style-type: none"> Use hammer to remove soil from bucket. / Keep grip hand clear of bucket / hammer. Use probing tool such as screwdriver to remove higher plasticity soils. 	
Use of digging bar to remove rocks / debris (must have PM approval to use - Per XOM SAN "The digging bar (or any other tool) may not be advanced into	<ul style="list-style-type: none"> Injury from losing control of bar 		<ul style="list-style-type: none"> Always keep two hands on bar Keep head / face clear of end of bar Do not use excessive force when using bar 	

1 JOB STEPS	2 POTENTIAL HAZARDS	3 CRITICAL ACTIONS TO MITIGATE HAZARDS
soil that has not been probed or otherwise cleared; No tool should be utilized with inappropriate force that could cause damage;)	• Back injury	• Do not turn at waist, turn with arms and shoulders, keep feet square to hole.
4. Shoveling / transferring soil into drum	• Muscle strain / overexertion from shoveling	• When shoveling, move in straight lines, do not twist back to empty shovel or move dirt, step in direction. Switch arms (every ten to fifteen shovels) when shoveling to balance strain on back and arms. • Empty hand auger bucket directly into drum whenever possible. If transporting soil in 5-gallon buckets, fill each 1/2 way and balance load in two buckets.
	• Pinch points from drum lid	• Maintain required hand protection (listed above) when opening closing drum lids.
5. Decontaminating hand auger equipment	• Cut hazard	• Use bristle brush to clean auger blades. Keep hands clear of auger blades.
6. Backfilling hand auger boring	• Back strain from lifting	• Do not lift greater than 50 lbs. without assistance. Empty bags into 5-gallon buckets if > 50 Lbs.
	• Injury to hands	• Wear cut resistant level 3 gloves at all times when handling tools/equipment. (CSE5) • Thoroughly inspect shovel, do not use if damaged.
7. Cleaning Up and Departing the Site	• Trip hazards	• Ensure that surface completion matches existing grade. Do not leave open holes unattended, contact PM to discuss if work is not completed.
	• Back strain from moving drum	• Do not move drum without drum dolly, review JSA drum management 2012
CORE SAFETY EXPECTATIONS		
CSE1: Always follow Fall Protection standards when working at elevated heights		
CSE2: Always follow Written Permit Procedures regarding: confined space, hot work, subsurface work & gas testing		
CSE3: Always follow Lock Out/Tag Out (LOTO) procedures		
CSE4: Always follow Defeat of Critical Device procedures		
CSE5: Always follow written PPE requirements for the work being performed		
Field Change Section: document step, hazard and field change to capture/control hazards as seen during operations.		

1 Each Job or Operation consists of a set of steps. Be sure to list all the steps in the sequence that they are performed. Specify the equipment or other details to set the basis for the associated hazards in Column 2

2 A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **Contact** - struck against, struck by, harmful contact with (cut, abrasion); Caught - in, under, between, by objects; Fall - slip/trip, fall on same level, fall from height;
Strain/Overexertion - lifting, pushing/pulling, bending, twisting; **Energy Source** - electricity, pressure, compression/tension;
Exposure - Temperature extreme, radiation, noise, chemical burn, hazardous atmosphere.

3 Aligning with the first two columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective observable and quantified terms. Avoid subjective general statements such as "be careful" or "use as appropriate".

JOB SAFETY ANALYSIS

COMPANY/PROJECT NAME or ID/LOCATION (City, State)		Rev. No.: 11	<input type="checkbox"/> NEW <input checked="" type="checkbox"/> REVISED as of 7/11/2013	PAGES 2
WORK ACTIVITY: Soil Sampling				
The JSA covers the hazards encountered when collecting soil samples during: hand auger, slide hammer soil sampler, split spoon sampler, and acetate sleeve.				
Equipment: Auger, Auger Extension, Hammer, Chisel, Soil Sampling Equipment, Brush (to clean auger), Pipe Tape, Pipe Vise, Pipe Wrench, Box Wrenches, Slide Hammer, Chain Pipe Vise,				
DEVELOPMENT TEAM		POSITION/TITLE	REVIEWED BY	POSITION/TITLE
Eric Clark		Staff Geologist	Robert Hays	Sr. Project Manager
Ian Desjarlais		Staff Geologist	Majd Neameh	Assistant Project Manager
			Peter Petro	Corporate Health & Safety Manager
MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (SEE CRITICAL ACTIONS FOR TASK-SPECIFIC REQUIREMENTS)				
<input checked="" type="checkbox"/> REFLECTIVE VEST	<input checked="" type="checkbox"/> GOGGLES	<input type="checkbox"/> AIR PURIFYING	<input checked="" type="checkbox"/> GLOVES (Nitrile & Level 3 Cut Resistant)	
<input checked="" type="checkbox"/> HARD HAT	<input type="checkbox"/> FACE SHIELD	<input type="checkbox"/> RESPIRATOR	<input type="checkbox"/> OTHER	
<input type="checkbox"/> LIFELINE/HARNESS	<input checked="" type="checkbox"/> HEARING PROTECTION	<input type="checkbox"/> SUPPLIED RESPIRATOR		
<input type="checkbox"/> SAFETY GLASSES	<input checked="" type="checkbox"/> SAFETY SHOES	<input checked="" type="checkbox"/> PPE CLOTHING: Long sleeve protection required		
1. JOB STEPS		2. POTENTIAL HAZARDS		
1. Hand Auger Soil Sampling - Turning Auger (SUBSURFACE WORK PERMIT REQUIRE)		<ul style="list-style-type: none"> • Damage to underground utility: shock, explosion, chemical • Over exertion, strain, muscle pull, struck-by 		
		<ul style="list-style-type: none"> • Confirm subsurface protocol was completed and auger location cleared. (CSE2) • Use good body mechanics, wide stance, do not overly twist back while turning auger, use chest and arm strength. • Do not use cheater bar to provide extra force on T-handle. 		
2. Hand Auger Soil Sampling - Sample Collection		<ul style="list-style-type: none"> • Pinch, cut, scrape or puncture hazard from removing soil 		
		<ul style="list-style-type: none"> • Tap auger using hammer to loosen soil out of sleeve into sample container. • Do not put any body component in line-of-fire (within 1 foot) if using decontaminated screwdriver or chisel to pry soil from sleeve. • Block auger tips so they will not slip and come in contact with any body part while removing soil. • If sample container has preservative review MSDS, ensure use of correct protective gloves: HCL - Nitrile, Sodium Bisulfate - Nitrile, Methanol - Nitrile (Splash) Neoprene or PVC (immersion) • Inspect glassware for cracks before using to hold soil sample. Open slowly, place on level surface to prevent spilling any preservative. 		
3. Hand Auger Soil Sampling - Decontamination		<ul style="list-style-type: none"> • Exposure to impacted water/soil, cut or pinch/impact hazard 		
		<ul style="list-style-type: none"> • Make sure gloves are in good condition and not ripped before placing hands in decon water. (CSE5) • Use brush (not hand) to clean auger. Inspect for metal burrs on auger or auger extension before cleaning, file down if present. • Pinch or impact hazard from disconnecting auger extensions. If screw type connection, ensure threads coated with pipe tape to prevent locking. Use pipe vise if available to secure auger extensions. Use box wrenches (not adjustable wrenches or channel locks). If pin type keep hands 6 inches from connection points to prevent pinch hazard when reassembling. 		
4. Slide Hammer Soil Sampler - Sample Collection (SUBSURFACE WORK PERMIT REQUIRED)		<ul style="list-style-type: none"> • Damage to underground utility: shock, explosion, chemical exposure • Cut hazard loading sleeve into barrel • Impact, pinch, muscle pull hazards 		
		<ul style="list-style-type: none"> • Confirm subsurface protocol was completed and auger location cleared. (CSE2) • Inspect barrel to slide hammer to ensure no metal burrs are present. Inspect metal sleeve insert as well. Remove or replace if burrs are present. • Place sampler head on surface for soil sample to check depth to avoid being too short and overextending arm or back when striking sampler. 		

¹ JOB STEPS	² POTENTIAL HAZARDS	³ CRITICAL ACTIONS TO MITIGATE HAZARDS
5. Slide Hammer Soil Sampler - Sample Collection	• Impact, pinch, muscle pull hazards	<ul style="list-style-type: none"> • Check striking motion before applying heaving force to ensure arm and wrist movement are in straight lines and not at awkward angles. • Lift with legs and not back to extract sampler head when sampler is full. May need to use upward strikes to free equipment.
6. Slide Hammer Soil Sampler - Sample Removal	• Exposure to impacted Soil, Cut or Impact Hazard	<ul style="list-style-type: none"> • If sampler head is stuck, use pipe wrenches to free inner sleeve. Use chain pipe vise to secure head of sampler. Clear hands motion to prevent contact with other objects if wrench slips • Wear cut resistant and chemical protective gloves. (CSE5) • Inspect edges of sleeves from brass sample before capping to prevent cuts. • If sample container has preservative, review MSDS. Ensure use of correct protective gloves: HCL - Nitrile, Sodium Bisulfate - Nitrile, Methanol - Nitrile (Splash) Neoprene or PVC (immersion). (CSE5)
7. Slide Hammer Soil Sampler - Decontamination	• Exposure to impacted water/soil, cut or pinch/impact hazard	<ul style="list-style-type: none"> • Make sure gloves are in good condition and not ripped before placing hands in decon water. (CSE5) • Use brush (not hand) to clean sampler head. Be aware of metal burrs extensions or sampler head. • Pinch or impact hazard from disconnecting extensions. If screw type connection ensure threats coated with pipe tape to prevent locking. Use pipe vise if available to secure auger extensions and box wrenches not adjustable wrenches or channel locks. If pin type keep hands six inches away from connection points to prevent pinch hazard when reassembling.
8. Split Spoon Sampler - Sample Collection & Decontamination	• Line of Fire	<ul style="list-style-type: none"> • Review drilling company's JSA for sample handling. • Do not assist driller with handling of split spoon. Not trained on hazard recognition or protocol.
	• Burn or Cut or Scrape, or exposure to chemicals (rash or acute reaction)	<ul style="list-style-type: none"> • Geologic conditions during sample collection can make sample very hot. Test before grabbing and burning self. • Wear chemical and cut resistant gloves and goggles when handling soil. (CSE5) • Inspect edges of sleeves from brass sample before capping to prevent cuts. • If sample container has preservative, review MSDS. Ensure use of correct protective gloves: HCL - Nitrile, Sodium Bisulfate - Nitrile, Methanol - Nitrile (Splash) Neoprene or PVC (immersion). (CSE5) • Inspect glassware for cracks before using to hold soil sample. Open slowly, place on level surface to prevent spilling any preservative.
9. Acetate Sleeve - Sample Collection & Decontamination	• Line of Fire	<ul style="list-style-type: none"> • Review drilling company's JSA for sample handling. • Do not assist driller with handling of acetate sleeve. Not trained on hazard recognition or protocol.
	• Cut or Scrape	<ul style="list-style-type: none"> • Ensure driller is using vise to hold sleeve down when cutting sleeve with hand saw or opening sleeve for inspection with geoprobe. Review cutting process identifying line-of-fire hazards. • Wear chemical and cut resistant gloves and goggles when handling acetate sleeve. Edges of sleeve are very sharp cutting hazard. (CSE5) • If sample container has preservative, review MSDS. Ensure use of correct protective gloves: HCL - Nitrile, Sodium Bisulfate - Nitrile, Methanol - Nitrile (Splash) Neoprene or PVC (immersion). (CSE5) • Inspect glassware for cracks before using to hold soil sample. Open slowly, place on level surface to prevent spilling any preservative.

CORE SAFETY EXPECTATIONS

CSE1: Always follow Fall Protection standards when working at elevated heights

CSE2: Always follow Written Permit Procedures regarding: confined space, hot work, subsurface work & gas testing

CSE3: Always follow Lock Out/Tag Out (LOTO) procedures

CSE4: Always follow Defeat of Critical Device procedures

CSE5: Always follow written PPE requirements for the work being performed

- Each Job or Operation consists of a set of steps. Be sure to list all the steps in the sequence that they are performed. Specify the equipment or other details to set the basis for the associated hazards in Column 2
- A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **Contact** - struck against, struck by, harmful contact with (cut, abrasion); Caught - in, under, between, by objects; Fall - slip/trip, fall on same level, fall from height; **Strain/Overexertion** - lifting, pushing/pulling, bending, twisting; **Energy Source** - electricity, pressure, compression/tension; **Exposure** - Temperature extreme, radiation, noise, chemical burn, hazardous atmosphere.
- Aligning with the first two columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific.

¹ JOB STEPS	² POTENTIAL HAZARDS	³ CRITICAL ACTIONS TO MITIGATE HAZARDS
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Use objective observable and quantified terms. Avoid subjective general statements such as "be careful" or "use as appropriate".



JSA

JOB SAFETY ANALYSIS

For RM Department Use
 Primary Category:
EM - Environmental Management
 Secondary Category:
 JSA NO. **EM-002d**

DESCRIPTION OF JOB: Well installation		OPERATOR JOB CLASSIFICATION: Field Technician	DATE: 4/22/08	REVISION:
PREPARED BY: Dan Mickelsen	REVIEWED BY: Dan Mickelsen	APPROVED BY: Dan Mickelsen	PAGE: of	
MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT				
<input checked="" type="checkbox"/> REFLECTIVE VEST <input checked="" type="checkbox"/> HARD HAT <input checked="" type="checkbox"/> SAFETY TOED BOOTS <input checked="" type="checkbox"/> SAFETY GLASSES <input checked="" type="checkbox"/> FACE SHIELD	<input checked="" type="checkbox"/> LONG PANTS <input checked="" type="checkbox"/> COTTON, LEATHER, OR CRAFTSMAN GLOVES <input type="checkbox"/> CHEMICAL RESISTANT GLOVE: <input checked="" type="checkbox"/> HEARING PROTECTION	<input type="checkbox"/> AIR PURIFYING RESPIRATOR <input type="checkbox"/> SUPPLIED AIR RESPIRATOR <input type="checkbox"/> CHEMICAL RESISTANT CLOTHING: <input type="checkbox"/> GOGGLES	<input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER:	
REQUIRED TOOLS/EQUIPMENT/SUPPLIES				
<input type="checkbox"/> DRINKING WATER <input type="checkbox"/> BUG REPELLENT <input checked="" type="checkbox"/> TRAFFIC CONTROL DEVICES <input type="checkbox"/> LADDER	<input type="checkbox"/> RATCHET WITH EXTENSION <input type="checkbox"/> WELL MAGNET <input type="checkbox"/> AIR MONITORING SELECT FROM LIST <input type="checkbox"/> LOCKOUT/TAGOUT EQUIPMENT	<input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER:	<input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER:	
1 JOB STEPS	2 POTENTIAL HAZARDOUS CONDITIONS or UNSAFE PRACTICES	3 SAFE PROCEDURES and PREVENTATIVE MEASURES		
Develop Sand Pack	Back injuries	<ul style="list-style-type: none"> Use proper lifting procedures – avoid lifting with the back and twisting. If over 50 pounds or awkward ask for assistance. Use cart or wheelbarrow to move the bags of sand close to the well opening. 		
	Hand pinch/cuts/crushed	<ul style="list-style-type: none"> Always watch hand placement – do not place your hand in direct path of a tool. Use craftsman, cotton or leather work gloves. 		
	Dust	<ul style="list-style-type: none"> Pour contents of bag near the well opening. Stand upwind and allow the wind to take any dust generated away from your breathing zone. Pour contents slowly. Do not use a chopping motion to open the bag this will cause dust to contact eyes. 		
Place PVC pipe	Back injuries	<ul style="list-style-type: none"> Use proper lifting procedures – avoid lifting with the back and twisting. If over 50 pounds or awkward ask for assistance. 		
	Falling pipe	<ul style="list-style-type: none"> Use proper attachment to lift casing. 		
	Hand injuries	<ul style="list-style-type: none"> Be alert for hand injuries. Do not use your hand as the tool. Use a hammer to move objects that are stuck. Use the right tool for the job. Be aware of hand placement – do not place hands in the path of hammers, knives or between objects. 		



JSA

JOB SAFETY ANALYSIS

For RM Department Use
 Primary Category:
EM - Environmental Management
 Secondary Category:
 JSA NO. **EM-002d**

DESCRIPTION OF JOB: Well installation		OPERATOR JOB CLASSIFICATION: Field Technician	DATE: 4/22/08	REVISION:
PREPARED BY: Dan Mickelsen	REVIEWED BY: Dan Mickelsen	APPROVED BY: Dan Mickelsen	PAGE: of	
MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT				
<input checked="" type="checkbox"/> REFLECTIVE VEST <input checked="" type="checkbox"/> HARD HAT <input checked="" type="checkbox"/> SAFETY TOED BOOTS <input checked="" type="checkbox"/> SAFETY GLASSES <input checked="" type="checkbox"/> FACE SHIELD	<input checked="" type="checkbox"/> LONG PANTS <input checked="" type="checkbox"/> COTTON, LEATHER, OR CRAFTSMAN GLOVES <input type="checkbox"/> CHEMICAL RESISTANT GLOVE: <input checked="" type="checkbox"/> HEARING PROTECTION	<input type="checkbox"/> AIR PURIFYING RESPIRATOR <input type="checkbox"/> SUPPLIED AIR RESPIRATOR <input type="checkbox"/> CHEMICAL RESISTANT CLOTHING: <input type="checkbox"/> GOGGLES	<input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER:	
REQUIRED TOOLS/EQUIPMENT/SUPPLIES				
<input type="checkbox"/> DRINKING WATER <input type="checkbox"/> BUG REPELLENT <input checked="" type="checkbox"/> TRAFFIC CONTROL DEVICES <input type="checkbox"/> LADDER	<input type="checkbox"/> RATCHET WITH EXTENSION <input type="checkbox"/> WELL MAGNET <input type="checkbox"/> AIR MONITORING SELECT FROM LIST <input type="checkbox"/> LOCKOUT/TAGOUT EQUIPMENT	<input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER:	<input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER:	
1 JOB STEPS	2 POTENTIAL HAZARDOUS CONDITIONS or UNSAFE PRACTICES	3 SAFE PROCEDURES and PREVENTATIVE MEASURES		
		<ul style="list-style-type: none"> Wear cotton, leather or craftsman gloves. Communicate your intentions to others involved. Make sure they understand where and what you will be doing before you do it. 		
Remove auger as well is advanced	Back injuries	<ul style="list-style-type: none"> Use proper lifting procedures – avoid lifting with the back and twisting. If over 50 pounds or awkward ask for assistance. Use a winch cable as a mechanical lift for auger pieces. Tip the auger up on one end and roll the auger into place. 		
	Hot auger	<ul style="list-style-type: none"> Do not touch the auger without gloves Allow auger to cool down before handling Use water to assist with cooling process 		
	Hand pinch/cuts/crushed	<ul style="list-style-type: none"> Be alert for hand injuries. Do not use your hand as the tool. Use a hammer to move objects that are stuck. Use the right tool for the job. Be aware of hand placement – do not place hands in the path of hammers, knives or between objects. Wear cotton, leather or craftsman gloves. Communicate your intentions to others involved. Make sure they understand where and what you will be doing before you do it. 		



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REQUIRED TOOLS/EQUIPMENT/SUPPLIES				
<input type="checkbox"/> DRINKING WATER <input type="checkbox"/> BUG REPELLENT <input checked="" type="checkbox"/> TRAFFIC CONTROL DEVICES <input type="checkbox"/> LADDER	<input type="checkbox"/> RATCHET WITH EXTENSION <input type="checkbox"/> WELL MAGNET <input type="checkbox"/> AIR MONITORING SELECT FROM LIST <input type="checkbox"/> LOCKOUT/TAGOUT EQUIPMENT	<input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER:	<input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER:	
1 JOB STEPS	2 POTENTIAL HAZARDOUS CONDITIONS or UNSAFE PRACTICES	3 SAFE PROCEDURES and PREVENTATIVE MEASURES		
	Slips, Trips and Falls	<ul style="list-style-type: none"> Maintain housekeeping. Set up work zone with enough room for staging of equipment and supplies such that there are aisle ways for walking and working. If on pavement or concrete sweep up loose sand, dirt or rock before lifting or moving equipment. Wear slip resistant steel toed boots. Keep foot wear clean of mud and other debris. Setup a boot cleaning area if needed. Dry up water as quickly as possible. Continue to clean and remove cuttings from drilling area. Pickup tools that are not needed and place out of the way. Walk your pathway before carrying an item. Maintain three points of contact when climbing up and down. Always face the climbing surface. If breaking a bolt on an auger make sure you have clean foot wear and work area, face the wrench and only use one foot on the wrench while holding onto a secure area that will not move. 		
Mixing water and grout	Back injuries	<ul style="list-style-type: none"> Use proper lifting procedures – avoid lifting with the back and twisting. If over 50 pounds or awkward ask for assistance. 		



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PREPARED BY: Dan Mickelsen	REVIEWED BY: Dan Mickelsen	APPROVED BY: Dan Mickelsen	PAGE: of
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MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT

<input checked="" type="checkbox"/> REFLECTIVE VEST <input checked="" type="checkbox"/> HARD HAT <input checked="" type="checkbox"/> SAFETY TOED BOOTS <input checked="" type="checkbox"/> SAFETY GLASSES <input checked="" type="checkbox"/> FACE SHIELD	<input checked="" type="checkbox"/> LONG PANTS <input checked="" type="checkbox"/> COTTON, LEATHER, OR CRAFTSMAN GLOVES <input type="checkbox"/> CHEMICAL RESISTANT GLOVE: <input checked="" type="checkbox"/> HEARING PROTECTION	<input type="checkbox"/> AIR PURIFYING RESPIRATOR <input type="checkbox"/> SUPPLIED AIR RESPIRATOR <input type="checkbox"/> CHEMICAL RESISTANT CLOTHING: <input type="checkbox"/> GOGGLES	<input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER:
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REQUIRED TOOLS/EQUIPMENT/SUPPLIES

<input type="checkbox"/> DRINKING WATER <input type="checkbox"/> BUG REPELLENT <input checked="" type="checkbox"/> TRAFFIC CONTROL DEVICES <input type="checkbox"/> LADDER	<input type="checkbox"/> RATCHET WITH EXTENSION <input type="checkbox"/> WELL MAGNET <input type="checkbox"/> AIR MONITORING SELECT FROM LIST <input type="checkbox"/> LOCKOUT/TAGOUT EQUIPMENT	<input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER:	<input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER:
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1 JOB STEPS	2 POTENTIAL HAZARDOUS CONDITIONS or UNSAFE PRACTICES	3 SAFE PROCEDURES and PREVENTATIVE MEASURES
		<ul style="list-style-type: none"> Take turns mixing the grout or if possible use an automated mixer. Do not lean over the drum while mixing. Take breaks when needed and change position.
	Noise	<ul style="list-style-type: none"> Wear hearing protection when pump and drill rig are operating
	Splash with water grout mix	<ul style="list-style-type: none"> Wear face shield with safety glasses Slowly introduce water into the mix and use a long handle shovel to mix.
	Hand pinch/cuts/crushed	<ul style="list-style-type: none"> Wear work gloves – cotton, leather or craftsman while working. Watch hand placement – always know where your hands are at. Do not place your hand in direct path of a tool or between two objects.
	Dust	<ul style="list-style-type: none"> Pour contents of bag near the drum or mixing container opening. Stand upwind and allow the wind to take any dust generated away from your breathing zone. Pour contents slowly. Do not use a chopping motion to open the bag this will cause dust to contact eyes. Use dust goggles.



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1 JOB STEPS	2 POTENTIAL HAZARDOUS CONDITIONS or UNSAFE PRACTICES	3 SAFE PROCEDURES and PREVENTATIVE MEASURES		
	Slips, trips and falls	<ul style="list-style-type: none"> Maintain housekeeping. Set up work zone with enough room for staging of equipment and supplies such that there are aisle ways for walking and working. If on pavement or concrete sweep up loose sand, dirt or rock. Wear slip resistant steel toed boots. Keep foot wear clean of mud and other debris. Dry up water as quickly as possible. Place pallet of material close to work area to minimize walking and carrying items. 		
	Chemical contact – skin	<ul style="list-style-type: none"> Do not contact wet grout without nitrile gloves on. Nitrile gloves can be worn under other gloves. Wash off with clean water. Do not use hands to mix. 		
Place well vault	Back injuries	<ul style="list-style-type: none"> Use proper lifting procedures – avoid lifting with the back and twisting. If over 50 pounds or awkward ask for assistance. 		
	Hand pinch/cuts/crushed	<ul style="list-style-type: none"> Be alert for hand injuries. Do not use your hand as the tool. Use the right tool for the job. Be aware of hand placement – do not place your hands between object. Wear cotton, leather or craftsman work gloves. 		



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1 JOB STEPS	2 POTENTIAL HAZARDOUS CONDITIONS or UNSAFE PRACTICES	3 SAFE PROCEDURES and PREVENTATIVE MEASURES		
	Slips, trips and falls	<ul style="list-style-type: none"> Set up work zone with enough room for staging of equipment and supplies such that there are aisle ways for walking and working. If on pavement or concrete sweep up loose sand, dirt or rock. Wear slip resistant steel toed boots. Keep foot wear clean of mud and other debris. 		
Pumping grout around well casing	Pressurized lines	<ul style="list-style-type: none"> Reverse pump to remove excess pressure. Open bleed off valve. Slowly disconnect pipes allowing excess pressure to escape. Wear face shield when disconnecting and pumping grout around well vault. 		
	Back injuries	<ul style="list-style-type: none"> Use proper lifting procedures – avoid lifting with the back and twisting. If over 50 pounds or awkward ask for assistance. 		
	Slips, Trips and Falls	<ul style="list-style-type: none"> Maintain housekeeping. Set up work zone with enough room for staging of equipment and supplies such that there are aisle ways for walking and working. If on pavement or concrete sweep up loose sand, dirt or rock. Wear slip resistant steel toed boots. Keep foot wear clean of mud and other debris. 		



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<input checked="" type="checkbox"/> REFLECTIVE VEST <input checked="" type="checkbox"/> HARD HAT <input checked="" type="checkbox"/> SAFETY TOED BOOTS <input checked="" type="checkbox"/> SAFETY GLASSES <input checked="" type="checkbox"/> FACE SHIELD	<input checked="" type="checkbox"/> LONG PANTS <input checked="" type="checkbox"/> COTTON, LEATHER, OR CRAFTSMAN GLOVES <input type="checkbox"/> CHEMICAL RESISTANT GLOVE: <input checked="" type="checkbox"/> HEARING PROTECTION	<input type="checkbox"/> AIR PURIFYING RESPIRATOR <input type="checkbox"/> SUPPLIED AIR RESPIRATOR <input type="checkbox"/> CHEMICAL RESISTANT CLOTHING: <input type="checkbox"/> GOGGLES	<input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER:	
REQUIRED TOOLS/EQUIPMENT/SUPPLIES				
<input type="checkbox"/> DRINKING WATER <input type="checkbox"/> BUG REPELLENT <input checked="" type="checkbox"/> TRAFFIC CONTROL DEVICES <input type="checkbox"/> LADDER	<input type="checkbox"/> RATCHET WITH EXTENSION <input type="checkbox"/> WELL MAGNET <input type="checkbox"/> AIR MONITORING SELECT FROM LIST <input type="checkbox"/> LOCKOUT/TAGOUT EQUIPMENT	<input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER:	<input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER: <input type="checkbox"/> OTHER:	
1 JOB STEPS	2 POTENTIAL HAZARDOUS CONDITIONS or UNSAFE PRACTICES	3 SAFE PROCEDURES and PREVENTATIVE MEASURES		
		<ul style="list-style-type: none"> • Dry up water as quickly as possible. 		
	Hand cuts and pinches	<ul style="list-style-type: none"> • Be alert for hand injuries. • Do not use your hand as the tool. • Use the right tool for the job. • Be aware of hand placement – do not place hands in the path of hammers, knives or between objects. • Wear cotton, leather or craftsman work gloves. 		
	Noise	<ul style="list-style-type: none"> • Wear hearing protection 		
	Valve failing	<ul style="list-style-type: none"> • Clean valves and pipe after every use. • Verify valves are operational before the start of the work. If the valve is difficult to move, make sure system is off and remove valve to determine if it needs to be replaced or cleaned. • Do not force a valve open. The use of only one hand is needed to open a functional valve. 		

JOB SAFETY ANALYSIS

COMPANY/PROJECT NAME or ID/LOCATION (City, State)		Rev. No.: 13	<input type="checkbox"/> NEW <input checked="" type="checkbox"/> REVISED as of 3/14/14	2 PAGES
WORK ACTIVITY: GROUNDWATER SAMPLING				
Routine sampling of groundwater wells on property. Working in remote area around livestock. Requires the use of the Monitoring and Gauging JSA				
Equipment: Screwdriver, Ratchet, Pry Bar, Groundwater Sampling Equipment and Sample Containers				
DEVELOPMENT TEAM		POSITION/TITLE		REVIEWED BY
Azat Magdanov		QM Technician		Jennifer Lacy
Steve Church		QM Technician		Peter Petro
				David Daniels
				Project Manager
MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (SEE CRITICAL ACTIONS FOR TASK-SPECIFIC REQUIREMENTS):				
<input checked="" type="checkbox"/> REFLECTIVE VEST	<input type="checkbox"/> GOGGLES	<input type="checkbox"/> AIR PURIFYING	<input checked="" type="checkbox"/> GLOVES (Cut resistant & nitrile)	
<input checked="" type="checkbox"/> HARD HAT	<input type="checkbox"/> FACE SHIELD	<input type="checkbox"/> RESPIRATOR	<input type="checkbox"/> OTHER:	
<input type="checkbox"/> LIFELINE/HARNES	<input type="checkbox"/> HEARING PROTECTION	<input type="checkbox"/> SUPPLIED RESPIRATOR		
<input checked="" type="checkbox"/> SAFETY GLASSES	<input checked="" type="checkbox"/> SAFETY SHOES	<input checked="" type="checkbox"/> PPE CLOTHING: Long sleeve protection required		
JOB STEPS:		POTENTIAL HAZARDS:		CRITICAL ACTIONS TO MITIGATE HAZARDS:
1. Maneuvering Vehicle/Trailer On Site		<ul style="list-style-type: none"> Collision with person/vehicle/property - damage to property, person being hit and run over Items falling from truck 		<ul style="list-style-type: none"> Communicate with other onsite personnel where work is taking place and how long it will take. Visually assess pathway before relocating vehicle to ensure safe route before moving. Clear communication between spotter and driver, including agreed position for spotter and hand signals for left, right, move and stop. Wear traffic vest. (CSE5) Driver must stop vehicle if spotter is not visible. Drive with the tailgate closed whenever possible. If the tailgate must remain open, strap down any loose items. Conduct a walk around of the vehicle before moving to another location. Secure loose items
2. Handling Equipment/Removing Well Lids		<ul style="list-style-type: none"> Over Exertion- Lifting Heavy Equipment Coming into contact with sharp and/or heavy objects Coming into Contact with objects Slips/Trips/Falls - cuts, broken bones, damage ligaments/tendons Exposure to Contaminants, biological hazards Heavy Well Lids/Covers - crushed or amputated fingers/toes 		<ul style="list-style-type: none"> Do not lift anything >40 lbs. without assistance. Keep aware of body positioning and use lifting techniques: Bend at knees, lift with legs, keep a straight back, tighten core muscles, keep load within 6 inches of body. Wear cut resistant level 3 gloves and safety shoes as defined by ANSI Z41. (CSE5) If lid is removable, store as close as possible. Clear of potential walkways to avoid tripping hazards. Consider placing lid underneath tailgate of truck if feasible. Watch for spiders and other insects before putting hands into well vaults. Use tool (screw driver) and visual inspection to explore well vault before reaching in with gloved hand. (CSE5) Wear cut resistant under and Nitrile over gloves. (CSE5) Keep hands/fingers away from raised covers. Use hand tools to initially lift and hold heavy covers; do not place fingers under lid Block opening to well with tool (ratchet, pry bar, etc.) to prevent lid from directly contacting ground/well skirt. Tool will take impact, not fingers or toes.

1. JOB STEPS	2. POTENTIAL HAZARDS	3. CRITICAL ACTIONS TO MITIGATE HAZARDS
3. Purging Wells	• Splash hazard when gauging wells	• Safety glasses with side shields must be worn at all times. (CSE5)
	• Exposure to Vapors and Airborne particulates	• Nitrile/cut resistant gloves must be worn while handling the bailer. (CSE5)
		Check for the presence of NAPL. Call PM if NAPL is encountered for instructions on how to proceed.
		If NAPL is confirmed and the PM decides to proceed with work on the well, consult the NAPL bailing JSA.
4. Collecting Groundwater Samples	• Contact with sharp objects (broken Sampling Bottles) - cuts	• Keep lids closed on poly tanks and drums as much as possible.
		• Use clear glass VOAs.
		• Visually inspect each glass bottle for defects prior to use.
	• Sample bottle falling and breaking - exposure to impacted water, cuts	• Place VOA in holding device and then tighten on lid
		• Wear cut-resistant gloves under Nitrile gloves while handling glass sample bottles. (CSE5)
		• Large sample containers must be secured in event it tips. Place large sample container in plastic tote or box to secure while opening, filling and closing container.
5. Locking Well Caps	• Exposure to Contaminants, biological hazards, cuts to hands	• Review Sample Packing SOP before packing and shipping samples.
		• Wear cut resistant level 3 under and Nitrile over gloves. (CSE5)
		• The well cap must be effectively sealing well and be locked.
6. Cleaning Up and Departing the Site	• Slips, trips and falls - results in broken bones and torn ligaments/tendons	• Watch for spiders and other insects before putting hands into well vaults. Use tool (screw driver) and visual inspection to explore well vault before reaching in with gloved hand. (CSE5)
		• Check that well covers are secure upon departure, and that all tools and bailing equipment are removed from the site.
	• Demobilization	• Walk around site and vehicle to perform a visual inspection before demobilization.
		• Review Driving JSA
Field Change Section: document step, hazard and field change to capture/control hazards as seen during operations.		

CORE SAFETY EXPECTATIONS

CSE1: Always follow Fall Protection standards when working at elevated heights

CSE2: Always follow Written Permit Procedures regarding: confined space, hot work, subsurface work & gas testing

CSE3: Always follow Lock Out/Tag Out (LOTO) procedures

CSE4: Always follow Defeat of Critical Device procedures

CSE5: Always follow written PPE requirements for the work being performed

1 Each Job or Operation consists of a set of steps. Be sure to list all the steps in the sequence that they are performed. Specify the equipment or other details to set the basis for the associated hazards in Column 2

2 A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **Contact** - struck against, struck by, harmful contact with (cut, abrasion); Caught - in, under, between, by objects; Fall - slip/trip, fall on same level, fall from height; **Strain/Overexertion** - lifting, pushing/pulling, bending, twisting; **Energy Source** - electricity, pressure, compression/tension; **Exposure** - Temperature extreme, radiation, noise, chemical burn, hazardous atmosphere.

3 Aligning with the first two columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective observable and quantified terms. Avoid subjective general statements such as "be careful" or "use as appropriate".

JOB SAFETY ANALYSIS

COMPANY/PROJECT NAME or ID/LOCATION (City, State)		Rev. No.:	<input type="checkbox"/> NEW <input checked="" type="checkbox"/> REVISED as of 2/20/2013	2 PAGES
WORK ACTIVITY: MONITORING AND GAUGING				
Routine gauging and monitoring groundwater wells both on site and off site. Working in a remote area around livestock.				
Equipment: Wrench, Screwdriver, Pry Bar				
DEVELOPMENT TEAM		POSITION/TITLE		REVIEWED BY
Aaron Ulishney		Project Geologist		Jennifer Lacy
Chris Bumgarner		Senior Technician		Peter Petro
Jonathan Love		Staff Geologist		Jake Prowse
				LPS Manager
				Corpora H&S Manager
				QM Manager
MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (SEE CRITICAL ACTIONS FOR TASK-SPECIFIC REQUIREMENTS)				
<input checked="" type="checkbox"/> REFLECTIVE VEST <input checked="" type="checkbox"/> HARD HAT <input type="checkbox"/> LIFELINE/HARNESS <input checked="" type="checkbox"/> SAFETY GLASSES	<input type="checkbox"/> GOGGLES <input type="checkbox"/> FACE SHIELD <input type="checkbox"/> HEARING PROTECTION <input checked="" type="checkbox"/> SAFETY SHOES	<input type="checkbox"/> AIR PURIFYING <input type="checkbox"/> RESPIRATOR <input type="checkbox"/> SUPPLIED RESPIRATOR <input checked="" type="checkbox"/> PPE CLOTHING: long sleeve shirt and pants	<input checked="" type="checkbox"/> GLOVES (Nitrile & Cut Resistant Level 3) <input type="checkbox"/> OTHER:	
JOB STEPS		POTENTIAL HAZARDS		CRITICAL ACTIONS TO MITIGATE HAZARDS
1. Movement of equipment and vehicles on/off site		<ul style="list-style-type: none"> Items falling from truck or inside trailer 		<ul style="list-style-type: none"> Drive with the tailgate closed whenever possible. If the tailgate must remain open, strap down any loose items.
				<ul style="list-style-type: none"> Stow equipment in cabinets and close cabinets inside trailer. Keep sample containers in coolers.
2. Establishing Work Zones		<ul style="list-style-type: none"> Vehicle or pedestrian traffic entering the work zone; danger of being struck by a vehicle 		<ul style="list-style-type: none"> Review Traffic Control JSA for detail hazard mitigation
				<ul style="list-style-type: none"> Use traffic watch in high risk traffic areas and when a second person is on site. For work in high pedestrian areas use traffic cage.
3. Handling Equipment / Opening / Removing Well Lids		<ul style="list-style-type: none"> Over Exertion- Lifting Heavy Equipment 		<ul style="list-style-type: none"> Do not lift anything over 40 lbs. without assistance. Bend knees and lift using legs/arms, not your back, keep the load close to your body, tighten stomach.
				<ul style="list-style-type: none"> Wear cut resistant gloves and steel toes boots. (CSE5)
		<ul style="list-style-type: none"> Coming into contact with sharp and/or heavy objects Crush/pinch/chop hazard from heavy well lids - loss of finger tip or broken finger 		<ul style="list-style-type: none"> When removing/opening well lids use wrench handle or screwdriver to place block between lid and ring incase lid slips it will not close in place.
				<ul style="list-style-type: none"> Use hand tools (i.e., pry bar) to initially lift and hold heavy covers
				<ul style="list-style-type: none"> Keep fingers and toes away from edge of well vault. Do not have fingers cross into well vault while opening lid.
<ul style="list-style-type: none"> Biological hazards - bit or stung causing injury 		<ul style="list-style-type: none"> Watch for spiders and other insects before putting hands into well vaults. Use tool (screw driver) and visual inspection to explore well vault before reaching in with gloved hand. 		
		<ul style="list-style-type: none"> Coming into Contact with objects Slips/Trips/Falls 		
4. Locking and Unlocking Well Caps		<ul style="list-style-type: none"> Exposure to Contaminants - splash or pressurized release of vapors 		<ul style="list-style-type: none"> Wear Nitrile gloves and cut resistant gloves. (CSE5)
				<ul style="list-style-type: none"> Loosen cap slowly, keeping control if pressure is release, keep face out of the line-of-fire
				<ul style="list-style-type: none"> Ensure well cap is effectively sealing well and properly locked
5. Gauging Wells		<ul style="list-style-type: none"> Fire/explosion hazards Exposure to Biological: biting and stinging Insects 		<ul style="list-style-type: none"> Do not smoke on site.
				<ul style="list-style-type: none"> Use tool (screwdriver) and visual inspection to explore well vault before reaching in with gloved hand. (CSE5)

¹ JOB STEPS	² POTENTIAL HAZARDS	³ CRITICAL ACTIONS TO MITIGATE HAZARDS
5. Gauging Wells	• Splash hazard when gauging wells	• Safety glasses with side shields must be worn at all times. (CSE5)
		• Nitrile and cut resistant gloves must be worn while handling the DTW/DTP probe and during deconning.
	• Exposure to Vapors and Airborne particulates	• Stop work if excessive odors are present in well and call Supervisor prior to continuing with task.
		• Wear safety glasses with side shields (CSE2)
		• Keep lids closed on poly tanks and drums as much as possible.
	• Contact with contaminated materials or exposure to standing water in well vault	• Hand bail or pump out free liquid before opening well cap.
6. Cleaning Up and Departing the Site	• Slips, trips and falls	• Check that well covers are secure upon departure, and that all tools and purging equipment are removed from the site.
		• Walk around site and conduct 360° vehicle visual inspection before demobilization
	• Leaving the site - vehicle accident	• Review Driving JSA
CORE SAFETY EXPECTATIONS		
<i>CSE1: Always follow Fall Protection standards when working at elevated heights</i>		
<i>CSE2: Always follow Written Permit Procedures regarding: confined space, hot work, subsurface work & gas testing</i>		
<i>CSE3: Always follow Lock Out/Tag Out (LOTO) procedures</i>		
<i>CSE4: Always follow Defeat of Critical Device procedures</i>		
<i>CSE5: Always follow written PPE requirements for the work being performed</i>		
Field Change Section: document step, hazard and field change to capture/control hazards as seen during operations.		

- Each Job or Operation consists of a set of steps. Be sure to list all the steps in the sequence that they are performed. Specify the equipment or other details to set the basis for the associated hazards in Column 2
- A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **Contact** - struck against, struck by, harmful contact with (cut, abrasion); Caught - in, under, between, by objects; Fall - slip/trip, fall on same level, fall from height; **Strain/Overexertion** - lifting, pushing/pulling, bending, twisting; **Energy Source** - electricity, pressure, compression/tension; **Exposure** - Temperature extreme, radiation, noise, chemical burn, hazardous atmosphere.
- Aligning with the first two columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective observable and quantified terms. Avoid subjective general statements such as "be careful" or "use as appropriate".

JOB SAFETY ANALYSIS

COMPANY/PROJECT NAME or ID/LOCATION (City, State)		Rev. No.: 10	<input type="checkbox"/> NEW <input checked="" type="checkbox"/> REVISED as of 1/31/14	2 PAGES
WORK ACTIVITY: CONSTRUCTION - TRENCHING & EXCAVATING Includes tasks and hazards for trenching/excavation of concrete/asphalt, engineered fill and native materials. Equipment: Heavy Equipment with Outriggers and Backup Alarm, Shovels, Breaker Bars, Brooms, Multi-Gas and/or PID, Non-Sparking Bucket or Blade for Earth Mover, "No Smoking" Signs, Marking Paint, Traffic-Rated Trench Plates, Lighted Barricades, Orange Construction Fence or/and Temporary Chain-Link Fencing				
DEVELOPMENT TEAM		POSITION/TITLE		REVIEWED BY
Henry Leone		Construction Worker / Foreman		Peter Petro
Ryan Rooks		Construction Worker / Foreman		Charlie Weber
				David Klemme
				Senior Engineer
MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (SEE CRITICAL ACTIONS FOR TASK SPECIFIC REQUIREMENTS)				
<input checked="" type="checkbox"/> REFLECTIVE VEST	<input checked="" type="checkbox"/> GOGGLES	<input type="checkbox"/> AIR PURIFYING	<input checked="" type="checkbox"/> GLOVES (Nitrile and Level 3 Cut Resistant)	
<input checked="" type="checkbox"/> HARD HAT	<input type="checkbox"/> FACE SHIELD	<input type="checkbox"/> RESPIRATOR	<input type="checkbox"/> OTHER (as specified in HASP)	
<input type="checkbox"/> LIFELINE/HARNES	<input checked="" type="checkbox"/> HEARING PROTECTION	<input type="checkbox"/> SUPPLIED RESPIRATOR		
<input type="checkbox"/> SAFETY GLASSES	<input checked="" type="checkbox"/> SAFETY SHOES	<input checked="" type="checkbox"/> PPE CLOTHING: Long sleeve protection required		
JOB STEPS		POTENTIAL HAZARDS		CRITICAL ACTIONS TO MITIGATE HAZARDS
1. Removing Asphalt or Concrete Using Heavy Equipment and Removing Soil Using Heavy Equipment or Hand Digging NOTE: THIS ACTIVITY REQUIRES A HOT WORK PERMIT		• Slips, trips and falls - resulting in broken bones, torn ligament/tendons		• Hard hat must be worn at all times. (CSE5) • Standing water, loose soil or backfill, loose parts, and tools are slip and trip hazards: keep out of walking paths, put tools away as soon as finished using. • Do not walk close to the edge of an excavation (within 5 ft. of an unshored wall) to avoid slips or cave-ins. (CSE1)
		• On-site workers may be injured or killed by heavy equipment		• Heavy equipment shall be checked daily and documented for proper operation and equipped with a back up alarm. • Do not allow personnel to stand within the swing radius of equipment booms or arms when equipment is in operation. Enter kill distance for equipment here: _____ ft., _____ ft., _____ ft. • When approaching operating equipment outside of kill radius use Hands Program (from the front and within the view of the operator, operator powers down equipment [placed in safe state where unintentional operation is impossible], shows you both of his/her hands being the signal it is safe to approach).
		• Heavy equipment may be unbalanced on unstable ground		• Where unstable soil exists, the soil should be assessed by a qualified professional engineer to ensure safe site conditions, stop work. Implement design control measures. • Stabilize equipment with outriggers if equipped
		• Back / muscle strains due to shoveling or lifting		• Ensure proper lifting techniques when conducting lifts; lift with legs, back straight, tighten core muscles (stomach), head looking forward. • Get help with objects that are too heavy (greater than 40 lbs.) or awkward for one person to lift. • When shoveling or sweeping, move in straight lines, do not twist back to empty shovel or move dirt, step in direction. Switch arms (every ten to fifteen shovels) when shoveling to balance strain on back and arms. • Use the proper tools (correct shovels, breaker bars) for each specific task. • Use heavy equipment (backhoe, bobcat) as much as possible to transport soil, asphalt/concrete or heavy equipment.
		• Injuries to hands		• Use the proper gloves for each specific task (Nitrile for chemical exposure [over glove] and level 3 cut resistant for all site work). (CSE5)
		• Hearing damage from working in areas of high noise		• Hearing protection must be worn when working around operating equipment. Rule of thumb, if you have to raise your voice to be heard from 2 feet away wear hearing protection (plugs, caps, or muff NRR > 28). (CSE5)

1. JOB STEPS	2. POTENTIAL HAZARDS	3. CRITICAL ACTIONS TO MITIGATE HAZARDS
	<ul style="list-style-type: none"> Unaware of Approaching Hazard due to Hearing Protection 	<ul style="list-style-type: none"> Use of hearing protection can limit one's ability to hear instructions, warnings or approaching traffic, etc. Rely on using your eyes to be aware of your surroundings, visually check on work environment every 10 minutes.
1. Removing Asphalt or Concrete Using Heavy Equipment and Removing Soil Using Heavy Equipment or Hand Digging NOTE: THIS ACTIVITY REQUIRES A HOT WORK PERMIT	<ul style="list-style-type: none"> Hazardous dust and/or particulate matter or organic vapors - resulting in lung damage or other organ acute or chronic health effects 	<ul style="list-style-type: none"> Visually monitor for dust and use the photo-ionization detector (PID) or other equipment to monitor hydrocarbon vapor concentrations. If air concentrations exceed action levels of 20 ppmv consistently in breathing zone, take corrective action or stop work until the condition subsides. (CSE2)
		<ul style="list-style-type: none"> Vapor suppressant or water spray may be used to control dust or to keep vapors from leaving the work zone.
		<ul style="list-style-type: none"> Mandatory use respirators if gasoline vapor reaches 100 ppmv. (CSE5)
		<ul style="list-style-type: none"> Use goggles to prevent dust and particulates from entering eye. (CSE5)
	<ul style="list-style-type: none"> Highly impacted hydrocarbon soil may ignite if sparks occur during removal by equipment contact with rocks or other buried objects. 	<ul style="list-style-type: none"> Attach a non-sparking bucket or blade to earth-moving equipment.
		<ul style="list-style-type: none"> If necessary, periodically wet the work area with water. Note: avoid creating slip hazard, do not create run-off when wetting soils.
		<ul style="list-style-type: none"> Conduct fire watch utilizing ERI's Hot Work Permit protocol with 20 lb. ABC fire extinguisher. (CSE2)
		<ul style="list-style-type: none"> Monitor the work area with a PID or lower explosion limit (LEL)/oxygen meter. Ensure vapor concentrations of < 10% LEL and below action levels. (CSE2)
	<ul style="list-style-type: none"> Potential fire, explosion or electrocution if underground utilities are damaged during excavation activities 	<ul style="list-style-type: none"> Post "No Smoking" signs; smoking on site is prohibited.
		<ul style="list-style-type: none"> The location of underground utilities, piping, and other services must be marked out prior to excavation activities.
2. Entering the Trench/Excavation	<ul style="list-style-type: none"> Possible suffocation or death due to soil cave-in 	<ul style="list-style-type: none"> Follow ExxonMobil subsurface clearance protocol and subsurface permit. (CSE2)
		<ul style="list-style-type: none"> Ensure that Underground Service Alert is notified and that the work area is cleared prior to activity. Missing USA marks is immediate STOP WORK, call PM. (CSE2)
	<ul style="list-style-type: none"> Toxic or flammable atmosphere 	<ul style="list-style-type: none"> Obtain the latest As-built drawing for the site and conduct a utility inspection.
		<ul style="list-style-type: none"> Do not enter an excavation that is greater than 4 feet deep unless it is professionally shored or sloped in accordance with ExxonMobil trenching protocol and OSHA requirements. (CSE2)
	<ul style="list-style-type: none"> Slips, trips and falls 	<ul style="list-style-type: none"> Ensure soil is stockpiled greater than 2 feet from the edge of excavation.
		<ul style="list-style-type: none"> Test the atmosphere prior to entry for oxygen content ($23 > O_2 > 19.5$), LEL percentage (<10%) and toxic vapor concentrations (< PEL). (CSE2)
3. Securing, Cleaning-Up	<ul style="list-style-type: none"> Possibility of personnel or pedestrians falling into the open excavated area and sustaining injury or death 	<ul style="list-style-type: none"> Do not enter an excavation that is greater than 4 feet deep without completed air monitoring compliance and documentation.
		<ul style="list-style-type: none"> Do not jump across an open trench; instead, walk around it. (CSE1)
		<ul style="list-style-type: none"> Use a trench plate to cover the area of the open trench that is not currently being worked upon.
	<ul style="list-style-type: none"> Eye damage dust, dirt entering 	<ul style="list-style-type: none"> OIMS requires lighted barricades if the excavation is to be left overnight
		<ul style="list-style-type: none"> Install an orange construction fence or and temporary chain-link fencing around the excavated area. (CSE1)

CORE SAFETY EXPECTATIONS

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CSE4: Always follow Defeat of Critical Device procedures

CSE5: Always follow written PPE requirements for the work being performed

JOB SAFETY ANALYSIS

COMPANY/PROJECT NAME or ID/LOCATION (City, State)		Rev. #	<input type="checkbox"/> NEW <input checked="" type="checkbox"/> REVISED as of 1/31/14	2 PAGES
WORK ACTIVITY: DRILLING OVERSIGHT - DIRECT PUSH, SAMPLE COLLECTION, DECONSTRUCTION				
Drilling hazard activities covered are: ground disturbance, ground intrusion, bin/drum management, site cleanup and drum relocation.				
Equipment: Traffic Control Devices, Temporary Fencing, Traffic Barricades and/or Delineators with Caution Tape, Defined Work Area Signs, Drill Rig, Borehole Plates, Multi-Gas Meter, Air Knife Equipment, Multi-Gas Meter and/or PID				
DEVELOPMENT TEAM	POSITION/TITLE	REVIEWED BY	POSITION/TITLE	
Jennifer Lacy	LPS Manager	Peter Petro	Corporate H&S Manager	
Ryan Pozzuto	Staff Scientist	Jennifer Lacy	LPS Manager	
Phil Cordell	Staff Geologist			
MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (SEE CRITICAL ACTIONS FOR TASK-SPECIFIC REQUIREMENTS)				
<input checked="" type="checkbox"/> REFLECTIVE VEST	<input checked="" type="checkbox"/> GOGGLES	<input type="checkbox"/> AIR PURIFYING	<input checked="" type="checkbox"/> GLOVES (Nitrile & Level 3 Cut Resistant)	
<input checked="" type="checkbox"/> HARD HAT	<input type="checkbox"/> FACE SHIELD	<input type="checkbox"/> RESPIRATOR		
<input type="checkbox"/> LIFELINE/HARNES	<input checked="" type="checkbox"/> HEARING PROTECTION	<input type="checkbox"/> SUPPLIED RESPIRATOR		
<input type="checkbox"/> SAFETY GLASSES	<input checked="" type="checkbox"/> SAFETY SHOES	<input checked="" type="checkbox"/> PPE CLOTHING: Long sleeve protection required		
1 JOB STEPS		2 POTENTIAL HAZARDS		3 CRITICAL ACTIONS TO MITIGATE HAZARDS
1. Setup for Direct Push		• Multiple Task Hazards		• Requires review and use of JSA Drilling Oversight -Direct Push Setup
2. Ground Disturbance: Auger Boring Advancement/Direct Push Drill Rods (REQUIRES HOT WORK PERMIT and OIMS SUBSURFACE PROTOCOL)		• Faulty or Inappropriate Equipment		• Qualified driller must inspect drill rig prior to use; if found faulty and/or inappropriate, do not proceed until repaired or replaced
		• Operating Equipment		• Inspect all hand tools prior to use; if found faulty or inappropriate, do not proceed until repaired or replaced.
				• Clear area of obstructions and communicate with all workers involved that drilling is beginning.
				• Stay clear of moving drilling rods
				• Secure loose clothing, long hair and remove jewelry which can become entangled in operating equipment
				• Wear PPE including goggles, cut resistant gloves and safety shoes ANSI Z41. (CSE5)
				• Ensure that the "Hands Free" program is in use.
		• Suspended Loads		• Do not walk under suspended loads
				• When possible, remove overhead hazards promptly
				• Wear PPE including goggles, cut resistant gloves and safety shoes ANSI Z41. (CSE5)
• High Noise Levels		• Use hearing protection when equipment is operating. (CSE5)		
		• Request dB levels of operating equipment to establish single or double hearing protection. (CSE5)		
• Vapors and Airborne Particulates: Breathing and Explosion/Fire Hazards		• Monitor air concentrations using direct-reading, real-time instruments such as a LEL and/or PID meter(s)		
		• HOT WORK permit is required. (CSE2)		
		• 10% LEL in breathing zones require engineering controls to be implemented		
		• Stop work if hazardous conditions arise as identified in the SSP, until hazard is removed by taking the following actions in order: implementing engineering controls, implementing administrative controls, upgrade PPE. (CSE5)		
		• Wear PPE including goggles, dust masks (for particulates only, does not work for vapors) or respirators. (CSE5)		
		• Stay upwind whenever possible		
		• Identify windsock on mast or alternative means on nearby surroundings to determine wind direction		

JOB STEPS	POTENTIAL HAZARDS	CRITICAL ACTIONS TO MITIGATE HAZARDS
	• Impact to Subsurface Lines/Tanks	• Only drill in areas where underground features have been identified and cleared per SCP. If hole has to be moved, clear new location with air/water knife equipment first and ensure SCP specifications are met.
	• Impact to Subsurface Lines/Tanks	• Wear PPE including cut resistant gloves and hard hat. (CSE5)
	• Rod Removal Stuck Rod breaking striking Personnel	• Driller to understand limitations of rig and not force repeated blows trying to drive through restrictive formation
		• Use normal removal means for rod extraction. Do not use leveling jacks to apply upward force.
3. Air Monitoring	• Exposure to vapor and airborne contaminants	• While monitoring the air near a boring, keep yourself as far away as possible from the potential contaminants • Set up the PID to retain the highest value to eliminate having to read the display screen • Consider the use of an extension for the PID/LEL to increase the distance between the bore hole and the monitoring personnel • Make sure alarms are turned on -- audible and visible. • Wear respirator if the concentration reaches 100 PPM in your breathing air. (CSE5) • Notify all workers if the concentrations exceed 100 PPM in their breathing air. • If the concentrations exceed 100 PPM, increase the monitoring frequency to 7 minutes or between each rod change.
4. Ground Intrusion: Soil Samples Acetate Liners (REQUIRES HOT WORK PERMIT and OIMS Subsurface Protocol)	• Cut Hazards from accessing Soil Samples	• Open blades knives are not to be used for cutting acetate sleeve. • Acetate sleeve is to be secured when opened for logging or other soil investigation. • Level 3 cut resistant and nitril gloves to be worn when handling acetate sleeves. (CSE5) • Sleeves are to be cut away from operator.
5. Ensure bins/drums are properly secured and labeled	• Bins/drums could be removed from the sites and disposed of improperly or tampered	• Ensure correct signage and labeling is present on each side of bin and/or drum. • Ensure a chain and lock is present on the bin "picking eye" to discourage inadvertent bin removal. • Ensure bin top is secured and/or temporary fencing is secured.
6. Perform site cleanup/drum relocation	Back or muscle injury from moving heavy objects	• Conduct SPSA and keep alert for potential risk. • Review Drum Management JSA • Wear appropriate PPE including: cut resistant gloves and goggles
	• Slips/Trips and falls hazards	• Perform final site inspection to ensure well boxes are properly secured and all equipment is removed from site.
7. Weather	• Lightning strike	• Count the seconds between the flash and bang. • Every 5 seconds equals one mile. Greater than 30 seconds you are clear, 30 seconds or less means boom down and get to shelter. • All clear is 30 minutes from the last flash and bang that was 30 seconds or greater.
	• High wind	• Check with operator for maximum wind speeds at end of boom. • If wind approaches the maximum safe wind speed, boom down until wind speed decreases. • Wait 30 minutes after wind speed decreases.

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CSE4: Always follow Defeat of Critical Device procedures


CSE5: Always follow written PPE requirements for the work being performed

APPENDIX B

Chemical Hazard Information

ACETONE

ICSC: 0087

2-Propanone Dimethyl ketone Methyl ketone C_3H_6O / CH_3COCH_3 Molecular mass: 58.1 ICSC # 0087		 CAS # 67-64-1 RTECS # <u>AL3150000</u> UN # 1090 EC # 606-001-00-8 April 22, 1994 Validated Fi, review at IHE: 10/09/89	
TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Highly flammable.	NO open flames, NO sparks, and NO smoking.	Powder, alcohol-resistant foam, water in large amounts, carbon dioxide.
EXPLOSION	Vapour/air mixtures are explosive.	Closed system, ventilation, explosion-proof electrical equipment and lighting. Do NOT use compressed air for filling, discharging, or handling.	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE			
• INHALATION	Sore throat. Cough. Confusion. Headache. Dizziness. Drowsiness. Unconsciousness.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
• SKIN	Dry skin.	Protective gloves.	Remove contaminated clothes. Rinse skin with plenty of water or shower.

•EYES	Redness. Pain. Blurred vision. Possible corneal damage.	Safety spectacles or face shield . Contact lenses should not be worn.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION	Nausea. Vomiting. (Further see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Refer for medical attention.
SPILLAGE DISPOSAL		STORAGE	PACKAGING & LABELLING
Personal protection: self-contained breathing apparatus. Ventilation. Collect leaking liquid in sealable containers. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT wash away into sewer. Then wash away with plenty of water.		Fireproof. Separated from strong oxidants. Store in an area without drain or sewer access.	F symbol Xi symbol R: 11-36-66-67 S: 2-9-16-26 UN Hazard Class: 3 UN Packing Group: II
ICSC: 0087		Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.	

ICSC: 0087

ACETONE

<p>I M P O R T A N T D A T A</p>	<p>PHYSICAL STATE; APPEARANCE: COLOURLESS LIQUID , WITH CHARACTERISTIC ODOUR.</p> <p>PHYSICAL DANGERS: The vapour is heavier than air and may travel along the ground; distant ignition possible.</p> <p>CHEMICAL DANGERS: The substance can form explosive peroxides on contact with strong oxidants such as acetic acid, nitric acid, hydrogen peroxide. Reacts with chloroform and bromoform under basic conditions, causing fire and explosion hazard. Attacks plastic.</p> <p>OCCUPATIONAL EXPOSURE LIMITS: TLV: 500 ppm as TWA, 750 ppm as STEL; A4 (not classifiable as a human carcinogen); BEI issued; (ACGIH 2004). MAK: 500 ppm 1200 mg/m³ Peak limitation category: I(2); Pregnancy risk group: D; (DFG 2006). OSHA PEL[†]: TWA 1000 ppm (2400 mg/m³) NIOSH REL: TWA 250 ppm (590 mg/m³) NIOSH IDLH: 2500 ppm 10%LEL See: 67641</p> <p>ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation and through the skin.</p> <p>INHALATION RISK: A harmful contamination of the air can be reached rather quickly on evaporation of this substance at 20° C; on spraying or dispersing, however, much faster.</p> <p>EFFECTS OF SHORT-TERM EXPOSURE: The vapour irritates the eyes and the respiratory tract. The substance may cause effects on the central nervous system , liver , kidneys and gastrointestinal tract .</p> <p>EFFECTS OF LONG-TERM OR REPEATED EXPOSURE: Repeated or prolonged contact with skin may cause dermatitis. The substance may have effects on the blood and bone marrow .</p>
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PHYSICAL PROPERTIES	Boiling point: 56°C Melting point: -95°C Relative density (water = 1): 0.8 Solubility in water: miscible Vapour pressure, kPa at 20°C: 24 Relative vapour density (air = 1): 2.0 Relative density of the vapour/air-mixture at 20°C (air = 1): 1.2 Flash point: -18°C c.c. Auto-ignition temperature: 465°C Explosive limits, vol% in air: 2.2-13 Octanol/water partition coefficient as log Pow: -0.24
ENVIRONMENTAL DATA	
NOTES	
Use of alcoholic beverages enhances the harmful effect. Transport Emergency Card: TEC (R)-30S1090 NFPA Code: H 1; F 3; R 0; Card has been partially updated in July 2007: see Occupational Exposure Limits. Card has been partially updated in January 2008: see Storage.	
ADDITIONAL INFORMATION	
ICSC: 0087	
ACETONE	
(C) IPCS, CEC, 1994	
IMPORTANT LEGAL NOTICE:	Neither NIOSH, the CEC or the IPCS nor any person acting on behalf of NIOSH, the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. The only modifications made to produce the U.S. version is inclusion of the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

Page last reviewed: July 22, 2015

Page last updated: July 1, 2014

Content source: Centers for Disease Control and Prevention (<http://www.cdc.gov/>)

MATERIAL SAFETY DATA SHEET PACKET

**National Institute of Standards and Technology
Standard Reference Materials Program
100 Bureau Drive, Stop 2300
Gaithersburg, Maryland 20899-2300**

**SRM Number: 1866b
SRM Name: Common Commercial
Asbestos**

Date of Issue: 09 January 2007

**MSDS Coordinator: Mario Cellarosi
Telephone: 301-975-6776
FAX: 301-926-4751
E-mail: SRMMSDS@nist.gov**

**Emergency Telephone Chem Trec:
1-800-424-9300 (North America)
+1-703-527-3887 (International)**

Description: Standard Reference Material (SRM) 1866b is comprised of three commercial-grade asbestos materials that were, or are, commonly used in commerce. These asbestos materials are typical of the asbestos found in bulk samples during routine asbestos inspections of building materials. The optical properties serve as a primary calibration standard in the identification of asbestos with polarized light microscopy (PLM). A unit of SRM 1866b consists of a set of three bottles: one bottle containing chrysotile, one bottle containing asbestiform grunerite (amosite), and one bottle containing asbestiform riebeckite (crocidolite). Each bottle contains between 1 gram and 3 grams of material.

Chrysotile

Asbestiform Grunerite (Amosite)

Asbestiform Riebeckite (Crocidolite)

An MSDS is provided for each of the three asbestos materials listed above, which contain hazardous components 1 % or greater and/or carcinogens 0.1 % or greater, in compliance with OSHA 29 CFR 1910.1200.

MATERIAL SAFETY DATA SHEET

1. SUBSTANCE AND SOURCE IDENTIFICATION

National Institute of Standards and Technology
Standard Reference Materials Program
100 Bureau Drive, Stop 2300
Gaithersburg, Maryland 20899-2300

SRM Number: 1866b
MSDS Number: 1866b
SRM Name: Common Commercial Asbestos

Date of Issue: 09 January 2007

MSDS Coordinator: Mario Cellarosi
Telephone: 301-975-6776
FAX: 301-926-4751
E-mail: SRMMSDS@nist.gov

Emergency Telephone ChemTrec:
1-800-424-9300 (North America)
+1-703-527-3887 (International)

Description: Standard Reference Material (SRM) 1866b is a set of three individual commercial-grade asbestos materials: **chrysotile**, asbestiform grunerite (amosite), and asbestiform riebeckite (crocidolite). A unit of SRM 1866b consists of three bottles, each containing between 1 gram and 3 grams of individual material.

Substance: Chrysotile

2. COMPOSITION AND INFORMATION ON HAZARDOUS INGREDIENTS^(a)

Component:	Chrysotile
Other Designations:	Chrysotile (metaxite; serpentine chrysotile; asbestos; chrysotile asbestos)
CAS Number:	12001-29-5
EC Number (EINECS):	Not assigned.
SRM Nominal Concentration (% by weight or volume):	> 90
Component:	Magnetite (as an impurity)
Other Designation:	Magnetite (magnetic iron oxide; black iron oxide; magnetic iron ore; lodestone; black ferric oxide)
CAS Number:	1309-38-2
EC Number (EINECS):	215-169-8
SRM Nominal Concentration (% by weight):	< 5
EC Classification:	T Carcinogen Category 1
EC Risk (R No.):	23, 45, 48
EC Safety (S No.):	45, 53

^(a) Hazardous components 1 % or greater; carcinogens 0.1 % or greater are listed in compliance with OSHA 29 CFR 1910.1200.

3. HAZARDS IDENTIFICATION

NFPA Ratings (Scale 0–4): Health = 1 Fire = 0 Reactivity = 0

Major Health Hazards: Cancer hazard (in humans)

Potential Health Effects

Inhalation:

Inhalation of chrysotile asbestos dust may be irritating. Symptoms include a cough and chest pain. Chronic exposure may cause asbestosis, interstitial fibrosis of the lung tissue, which may develop within 4 years to 9 years, but onset may be typically delayed 20 years to 40 years after first exposure. Death from asbestosis may be due to respiratory or cardiac failure. Secondary lung infections may also occur. Chronic exposure of asbestos to workers may also cause pleural effusion as early as 3 years to 4 years after initial exposure. Chronic exposure of asbestos to workers also increases the chance of pleural and peritoneal mesotheliomas, bronchogenic carcinoma, lung cancer, and cancers of the gastrointestinal tract and larynx. The latent period for mesothelioma is 3 years to 40 years; for lung cancer, 15 years to 30 years.

Skin Contact: Direct contact may cause irritation. Asbestos fibers may penetrate the skin and result in "asbestos corns", due to thickening of the skin around the implanted fiber. These corns usually occur on the hands and forearms, and they disappear on removal of the fibers.

Eye Contact: Direct contact may cause irritation with redness due to mechanical action.

Ingestion: Acute exposure by cause gastrointestinal irritation. Chronic exposure of asbestos fibers may be involved in cancers of the buccal cavity and pharynx, esophagus, stomach, colon, and rectum.

**Listed as a Carcinogen/
Potential Carcinogen:**

Yes	No	
<u>X</u>	_____	In the National Toxicology Program (NTP) Report on Carcinogens.
<u>X</u>	_____	In the International Agency for Research on Cancer (IARC) Monographs.
<u>X</u>	_____	By the Occupational Safety and Health Administration (OSHA).

4. FIRST AID MEASURES

Inhalation: If adverse effects occur, remove to uncontaminated area. If not breathing, give artificial respiration by qualified personnel. Get immediate medical attention.

Skin Contact: Rinse affected area with copious amounts of water followed by washing with soap and water for at least 15 minutes while removing contaminated clothing. Get immediate medical attention.

Eye Contact: Flush eyes, including under the eyelids, with copious amounts of water for at least 15 minutes. Get immediate medical attention.

Ingestion: If a large amount is swallowed, get immediate medical attention.

5. FIRE FIGHTING MEASURES

Fire and Explosion Hazards: Chrysotile is a negligible fire hazard.

Extinguishing Media: Regular dry chemical. Carbon dioxide. Water. Regular foam.

Fire Fighting: If material is involved in a fire, extinguish fire with a medium appropriate for the surrounding fire. Material itself does NOT burn or burns with difficulty. Keep run-off water out of sewers and water sources. Wear full protective clothing and NIOSH-approved self-contained breathing apparatus (SCBA).

Component: Chrysotile

Flash Point: Not applicable.

Method Used: Not applicable.

Autoignition Temp.: Not applicable.

Flammability Limits in Air

UPPER (Volume %): Not applicable.

LOWER (Volume %): Not applicable.

6. ACCIDENTAL RELEASE MEASURES

Occupational Release: Do NOT touch or walk through spilled material. Avoid inhalation of asbestos dust (see Section 8, "Exposure Controls and Personal Protection"). Collect small dry spills with a shovel and place material into an appropriate container for disposal. Prevent entry into waterways and sewers. Clean up residue with a HEPA filter vacuum.

Disposal: Refer to Section 13, "Disposal Considerations".

7. HANDLING AND STORAGE

Storage: Store and handle in accordance with all current regulations and standards.

Safe Handling Precautions: See Section 8, "Exposure Controls and Personal Protection".

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Exposure Limits:	Chrysotile OSHA (PEL): 0.1 fibers/cc TWA ACGIH (TLV): 0.1 fibers/cc TWA NIOSH: 0.1 fibers/cc recommended TWA (10 h)
Ventilation:	Provide local exhaust ventilation system equipped with a HEPA-filter dust collection system.
Respirator:	If workplace conditions warrant a respirator's use, a NIOSH/MSHA approved respirator should be used under an implemented respiratory protection program in accordance with OSHA Standard 29 CFR 1910.134 (General Industry, Use of Respirators) and 29 CFR 1910.1001 for occupational exposure to asbestos.
Eye Protection:	Wear safety goggles. An eye wash station should be readily available near areas of use.
Personal Protection:	Wear appropriate protective clothing and gloves to prevent skin exposure. Refer to OSHA Regulated Substances: OSHA 29 CFR 1910.1001.

9. PHYSICAL AND CHEMICAL PROPERTIES

Component:	Chrysotile
Appearance:	Fibrous solid to dust-like powder. White to grey-brown. Odorless.
Relative Molecular Mass:	Not applicable.
Molecular Formula:	$\text{Mg}_3(\text{Si}_2\text{O}_5)(\text{OH})_4$
Water Solubility:	Insoluble.
Solvent Solubility:	Insoluble in organic solvents.

10. STABILITY AND REACTIVITY

Stability:	<u> X </u> Stable <u> </u> Unstable Stable at normal temperatures and pressure.
Conditions to Avoid:	Avoid generating dust. Keep out of water supplies and sewers.
Incompatible Materials:	May be attacked by strong acids.
Fire/Explosion Information:	See Section 5, "Fire Fighting Measures".
Hazardous Decomposition:	Completely decomposes at temperatures of 1 000 °C.
Hazardous Polymerization:	<u> </u> Will Occur <u> X </u> Will Not Occur

11. TOXICOLOGICAL INFORMATION

Route of Entry:	<u> X </u> Inhalation <u> X </u> Skin <u> X </u> Ingestion
Toxicity Data:	Chrysotile Human, Inhalation TCL_0 : 2.8 fibers/cc (5 years) Rat, Inhalation-Intermittent TCL_0 : 8 210 $\mu\text{g}/\text{m}^3$ (6 h to 20 d) Rat, Oral-Continuous TDL_0 : 10 867 mg/kg (78 weeks)
Tumorigenic, Reproductive, Mutagenic Data:	Chrysotile has been investigated as a tumorigenic and mutagenic effector.
Health Effects (Acute and Chronic):	See Section 3: "Hazards Identification" for potential health effects.

12. ECOLOGICAL INFORMATION

Ecotoxicity Data:	Not available.
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13. DISPOSAL CONSIDERATIONS

Waste Disposal: Dispose in accordance with all applicable federal, state, and local regulations.

14. TRANSPORTATION INFORMATION

U.S. DOT and IATA: Asbestos; UN2212; Hazard Class 9
NOTE: This material, as packaged for SRM 1866b, is not subject to the regulations per DOT Special Provision 156 and IATA special Provision A61.

15. REGULATORY INFORMATION

U.S. Regulations: CERCLA Sections 102a/103 (40 CFR 302.4): Asbestos: 1 lbs RQ
SARA Title III Section 302 (40 CFR 355.30): Not regulated.
SARA Title III Section 304 (40 CFR 355.40): Not regulated.
SARA Title III Section 313 (40 CFR 372.65): Asbestos.
OSHA Process Safety (29 CFR 1910.119): Not regulated.
SARA Title III Sections 311/312 Hazardous Categories (40 CFR 370.21):

ACUTE: No.
CHRONIC: Yes.
FIRE: No.
REACTIVE: No.
SUDDEN RELEASE: No.

State Regulations: California Proposition 65: Asbestos is known to the state of California to cause cancer (Feb. 17, 1987).

CANADIAN Regulations

WHMIS Classification: Not determined for this material.

EUROPEAN Regulations

EC Classification (assigned): T Toxic.
Carcinogen Category 1.

EC Risk Phrases: R45 May cause cancer.
R23/48 Toxic: danger of serious damage to health by prolonged exposure through inhalation.

EC Safety Phrases: S45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
S53 Avoid exposure.

National Inventory Status

U.S. Inventory (TSCA): Asbestos: Not listed on inventory.

TSCA 12(b)

Export Notification: Asbestos: CAS No.: 1332-21-4
Section 6

16. OTHER INFORMATION

Sources: MDL Information Systems, Inc., MSDS *Chrysotile*, 15 June 2006.

Disclaimer: Physical and chemical data contained in this MSDS are provided only for use as a guide in assessing the hazardous nature of the material. The MSDS was prepared carefully, using current references; however, NIST does not certify the data in the MSDS. The certified values for this material are given in the NIST Certificate of Analysis.

MATERIAL SAFETY DATA SHEET

1. SUBSTANCE AND SOURCE IDENTIFICATION

National Institute of Standards and Technology
Standard Reference Materials Program
100 Bureau Drive, Stop 2300
Gaithersburg, Maryland 20899-2300

SRM Number: 1866b
MSDS Number: 1866b
SRM Name: Common Commercial Asbestos

Date of Issue: 09 January 2007

MSDS Coordinator: Mario Cellarosi
Telephone: 301-975-6776
FAX: 301-926-4751
E-mail: SRMMSDS@nist.gov

Emergency Telephone ChemTrec:
1-800-424-9300 (North America)
+1-703-527-3887 (International)

Description: Standard Reference Material (SRM) 1866b is a set of three individual commercial-grade asbestos materials: chrysotile, **asbestiform grunerite (amosite)**, and asbestiform riebeckite (crocidolite). A unit of SRM 1866b consists of three bottles, each containing between 1 gram and 3 grams of individual material.

Substance: Asbestiform Grunerite

2. COMPOSITION AND INFORMATION ON HAZARDOUS INGREDIENTS^(a)

Component:	Asbestiform Grunerite
Other Designations:	Asbestiform Grunerite (grunerite; amosite; brown asbestos; amosite asbestos)
CAS Number:	12172-73-5
EC Number (EINECS):	Not assigned.
SRM Nominal Concentration (% by weight or volume):	> 90
Component:	Magnetite (as an impurity)
Other Designation:	Magnetite (magnetic iron oxide; black iron oxide; magnetic iron ore; lodestone; black ferric oxide)
CAS Number:	1309-38-2
EC Number (EINECS):	215-169-8
SRM Nominal Concentration (% by weight):	< 5
Component:	Quartz
Other Designation:	Quartz (alpha quartz; silicon dioxide; silica; silicic anhydride; agate)
CAS Number:	14808-60-7
EC Number (EINECS):	238-878-4
SRM Nominal Concentration (% by weight):	< 5
EC Classification:	T Carcinogen Category 1
EC Risk (R No.):	23, 45, 48
EC Safety (S No.):	45, 53

^(a) Hazardous components 1 % or greater; carcinogens 0.1 % or greater are listed in compliance with OSHA 29 CFR 1910.1200.

3. HAZARDS IDENTIFICATION

NFPA Ratings (Scale 0-4): Health = 1 Fire = 0 Reactivity = 0
Major Health Hazards: Cancer hazard (in humans)

Potential Health Effects**Inhalation:**

Inhalation of grunerite asbestos dust may be irritating. Symptoms include a cough and chest pain. Chronic exposure may cause asbestosis, interstitial fibrosis of the lung tissue, which may develop within 4 years to 9 years, but onset may be typically delayed 20 years to 40 years after first exposure. Death from asbestosis may be due to respiratory or cardiac failure. Secondary lung infections may also occur. Chronic exposure of asbestos to workers may also cause pleural effusion as early as 3 years to 4 years after initial exposure. Chronic exposure of asbestos to workers also increases the chance of pleural and peritoneal mesotheliomas, bronchogenic carcinoma, lung cancer, and cancers of the gastrointestinal tract and larynx. The latent period for mesothelioma is 3 years to 40 years; for lung cancer, 15 years to 30 years.

Skin Contact:

Direct contact may cause irritation. Asbestos fibers may penetrate the skin and result in "asbestos corns", due to thickening of the skin around the implanted fiber. These corns usually occur on the hands and forearms, and they disappear on removal of the fibers.

Eye Contact:

Direct contact may cause irritation with redness due to mechanical action.

Ingestion:

Acute exposure by cause gastrointestinal irritation. Chronic exposure of asbestos fibers may be involved in cancers of the buccal cavity and pharynx, esophagus, stomach, colon, and rectum.

**Listed as a Carcinogen/
Potential Carcinogen:**

Yes	No
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<u>X</u>	_____
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In the National Toxicology Program (NTP) Report on Carcinogens.

<u>X</u>	_____
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In the International Agency for Research on Cancer (IARC) Monographs.

<u>X</u>	_____
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By the Occupational Safety and Health Administration (OSHA).

4. FIRST AID MEASURES

Inhalation:

If adverse effects occur, remove to uncontaminated area. If not breathing, give artificial respiration by qualified personnel. Get immediate medical attention.

Skin Contact:

Rinse affected area with copious amounts of water followed by washing with soap and water for at least 15 minutes while removing contaminated clothing. Get medical attention, if needed.

Eye Contact:

Flush eyes, including under the eyelids, with copious amounts of water for at least 15 minutes. Get immediate medical attention.

Ingestion:

If a large amount is swallowed, get immediate medical attention.

5. FIRE FIGHTING MEASURES

Fire and Explosion Hazards:

Asbestiform grunerite is a negligible fire hazard.

Extinguishing Media:

Regular dry chemical. Carbon dioxide. Water. Regular foam.

Fire Fighting:

If material is involved in a fire, extinguish fire with a medium appropriate for the surrounding fire. Material itself does NOT burn or burns with difficulty. Keep run-off water out of sewers and water sources. Wear full protective clothing and NIOSH-approved self-contained breathing apparatus (SCBA).

Component:

Asbestiform Grunerite

Flash Point:

Not applicable.

Method Used:

Not applicable.

Autoignition Temp.:

Not applicable.

Flammability Limits in Air**UPPER (Volume %):**

Not applicable.

LOWER (Volume %):

Not applicable.

6. ACCIDENTAL RELEASE MEASURES

Occupational Release: Do NOT touch or walk through spilled material. Avoid inhalation of asbestos dust (see Section 8, "Exposure Controls and Personal Protection"). Collect small dry spills with a shovel and place material into an appropriate container for disposal. Prevent entry into waterways and sewers. Clean up residue with a HEPA filter vacuum.

Disposal: Refer to Section 13, "Disposal Considerations".

7. HANDLING AND STORAGE

Storage: Store and handle in accordance with all current regulations and standards.

Safe Handling Precautions: See Section 8, "Exposure Controls and Personal Protection".

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Exposure Limits: **Asbestiform Grunerite**
OSHA (PEL): 0.1 fibers/cc TWA
ACGIH (TLV): 0.1 fibers/cc TWA
NIOSH: 0.1 fibers/cc recommended TWA (10 h)

Quartz

OSHA (PEL): 0.3 mg/m³ TWA (total dust) 30 mg/m³/‰ SiO₂ + 2, based on size/aerodynamic characteristics)
OSHA (PEL): 0.1 mg/m³ TWA (respirable dust) 10 mg/m³/‰ SiO₂ + 2, based on size/aerodynamic characteristics)
ACGIH (TLV): 0.025 mg m³ TWA (respirable dust)
NIOSH: 0.05 mg/m³ recommended TWA (10 h) (respirable dust)
UK WEL: 0.3 mg/m³ TWA (respirable particulate) (Chemical Hazard Alert Notice issued).

Ventilation: Provide local exhaust ventilation system equipped with a HEPA-filter dust collection system.

Respirator: If workplace conditions warrant a respirator's use, a NIOSH/MSHA approved respirator should be used under an implemented respiratory protection program in accordance with OSHA Standard 29 CFR 1910.134 (General Industry, Use of Respirators) and 29 CFR 1910.1001 for occupational exposure to asbestos.

Eye Protection: Wear safety goggles. An eye wash station should be readily available near areas of use.

Personal Protection: Wear appropriate protective clothing and gloves to prevent skin exposure. Refer to OSHA Regulated Substances: OSHA 29 CFR 1910.1001.

9. PHYSICAL AND CHEMICAL PROPERTIES

Component: **Asbestiform Grunerite**
Appearance: Fibrous solid to dust-like powder. Grey-brown to light brown. Odorless.
Relative Molecular Mass: Not applicable.
Molecular Formula: Fe²⁺₇(Si₈O₂₂)(OH)₂
Water Solubility: Insoluble

10. STABILITY AND REACTIVITY

Stability: X Stable Unstable

Stable at normal temperatures and pressure.

Conditions to Avoid: Avoid generating dust. Keep out of water supplies and sewers.

Incompatible Materials: May be attacked by strong acids.

Fire/Explosion Information: See Section 5, "Fire Fighting Measures".

Hazardous Decomposition: Completely decomposes at temperatures of 1 000 °C.

Hazardous Polymerization: _____ Will Occur X Will Not Occur

11. TOXICOLOGICAL INFORMATION

Route of Entry: X Inhalation X Skin X Ingestion

Toxicity Data: **Asbestiform Grunerite**
Rat, Intrapleural TD_{LO}: 150 mg/kg

Tumorigenic, Reproductive, Mutagenic Data: Asbestiform grunerite has been investigated as a tumorigenic and mutagenic effector.

Health Effects (Acute and Chronic): See Section 3: "Hazards Identification" for potential health effects.

12. ECOLOGICAL INFORMATION

Ecotoxicity Data: Not available.

13. DISPOSAL CONSIDERATIONS

Waste Disposal: Dispose in accordance with all applicable federal, state, and local regulations.

14. TRANSPORTATION INFORMATION

U.S. DOT and IATA: **U.S. DOT and IATA:** Asbestos; UN2212; Hazard Class 9
NOTE: This material, as packaged for SRM 1866b, is not subject to the regulations per DOT Special Provision 156 and IATA special Provision A61.

15. REGULATORY INFORMATION

U.S. Regulations: CERCLA Sections 102a/103 (40 CFR 302.4): Asbestos: 1 lbs RQ.
SARA Title III Section 302 (40 CFR 355.30): Not regulated.
SARA Title III Section 304 (40 CFR 355.40): Not regulated.
SARA Title III Section 313 (40 CFR 372.65): Asbestos.
OSHA Process Safety (29 CFR 1910.119): Not regulated.
SARA Title III Sections 311/312 Hazardous Categories (40 CFR 370.21):

ACUTE: No.
CHRONIC: Yes.
FIRE: No.
REACTIVE: No.
SUDDEN RELEASE: No.

State Regulations: California Proposition 65: Asbestos is known to the state of California to cause cancer (Feb. 27, 1987).

**CANADIAN Regulations
WHMIS Classification:** Not determined for this material.

**EUROPEAN Regulations
EC Classification (assigned):** T Toxic.
Carcinogen Category 1

EC Risk Phrases: R45 May cause cancer.
R23/48 Toxic: danger of serious damage to health by prolonged exposure through inhalation.

EC Safety Phrases: S45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
S53 Avoid exposure.

National Inventory Status

U.S. Inventory (TSCA): Asbestos: Not listed on inventory.

**TSCA 12(b)
Export Notification:** Asbestos: CAS No.: 1332-21-4
Section 6

16. OTHER INFORMATION

Sources: MDL Information Systems, Inc., MSDS *Amosite*, 16 June 2005.

Disclaimer: Physical and chemical data contained in this MSDS are provided only for use as a guide in assessing the hazardous nature of the material. The MSDS was prepared carefully, using current references; however, NIST does not certify the data in the MSDS. The certified values for this material are given in the NIST Certificate of Analysis.

MATERIAL SAFETY DATA SHEET

1. SUBSTANCE AND SOURCE IDENTIFICATION

National Institute of Standards and Technology
Standard Reference Materials Program
100 Bureau Drive, Stop 2300
Gaithersburg, Maryland 20899-2300

SRM Number: 1866b
MSDS Number: 1866b
SRM Name: Common Commercial Asbestos

Date of Issue: 09 January 2007

MSDS Coordinator: Mario Cellarosi
Telephone: 301-975-6776
FAX: 301-926-4751
E-mail: SRMMSDS@nist.gov

Emergency Telephone ChemTrec:
1-800-424-9300 (North America)
+1-703-527-3887 (International)

Description: Standard Reference Material (SRM) 1866b is a set of three individual commercial-grade asbestos materials: chrysotile, asbestiform grunerite (amosite), and **asbestiform riebeckite (crocidolite)**. A unit of SRM 1866b consists of three bottles, each containing between 1 gram and 3 grams of individual material.

Substance: Asbestiform Riebeckite

2. COMPOSITION AND INFORMATION ON HAZARDOUS INGREDIENTS^(a)

Component:	Asbestiform Riebeckite
Other Designations:	Asbestiform Riebeckite (blue asbestos; crocidolite; asbestos; crocidolite asbestos)
CAS Number:	12001-28-4
EC Number (EINECS):	Not assigned.
SRM Nominal Concentration (% by weight or volume):	> 90
Component:	Magnetite (as an impurity)
Other Designation:	Magnetite (magnetic iron oxide; black iron oxide; magnetic iron ore; lodestone; black ferric oxide)
CAS Number:	1309-38-2
EC Number (EINECS):	215-169-8
SRM Nominal Concentration (% by weight):	< 5
EC Classification:	T Carcinogen Category 1
EC Risk (R No.):	23, 45, 48
EC Safety (S No.):	45, 53

^(a) Hazardous components 1 % or greater; carcinogens 0.1 % or greater are listed in compliance with OSHA 29 CFR 1910.1200.

3. HAZARDS IDENTIFICATION

NFPA Ratings (Scale 0–4): Health = 1 Fire = 0 Reactivity = 0

Major Health Hazards: Cancer hazard (in humans)

Potential Health Effects

Inhalation:

Inhalation of riebeckite asbestos dust may be irritating. Symptoms include a cough and chest pain. Chronic exposure may cause asbestosis, interstitial fibrosis of the lung tissue, which may develop within 4 years to 9 years, but onset may be typically delayed 20 years to 40 years after first exposure. Death from asbestosis may be due to respiratory or cardiac failure. Secondary lung infections may also occur. Chronic exposure of asbestos to workers may also cause pleural effusion as early as 3 years to 4 years after initial exposure. Chronic exposure of asbestos to workers also increases the chance of pleural and peritoneal mesotheliomas, bronchogenic carcinoma, lung cancer, and cancers of the gastrointestinal tract and larynx. The latent period for mesothelioma is 3 years to 40 years; for lung cancer, 15 years to 30 years.

Skin Contact: Direct contact may cause irritation. Asbestos fibers may penetrate the skin and result in "asbestos corns", due to thickening of the skin around the implanted fiber. These corns usually occur on the hands and forearms, and they disappear on removal of the fibers.

Eye Contact: Direct contact may cause irritation with redness due to mechanical action.

Ingestion: Acute exposure by cause gastrointestinal irritation. Chronic exposure of asbestos fibers may be involved in cancers of the buccal cavity and pharynx, esophagus, stomach, colon, and rectum.

**Listed as a Carcinogen/
Potential Carcinogen:**

Yes	No	
<u>X</u>	_____	In the National Toxicology Program (NTP) Report on Carcinogens.
<u>X</u>	_____	In the International Agency for Research on Cancer (IARC) Monographs.
<u>X</u>	_____	By the Occupational Safety and Health Administration (OSHA).

4. FIRST AID MEASURES

Inhalation: If adverse effects occur, remove to uncontaminated area. If not breathing, give artificial respiration by qualified personnel. Get immediate medical attention.

Skin Contact: Rinse affected area with copious amounts of water followed by washing with soap and water for at least 15 minutes while removing contaminated clothing. Get medical attention, if needed.

Eye Contact: Flush eyes, including under the eyelids, with copious amounts of water for at least 15 minutes. Get immediate medical attention.

Ingestion: Get immediate medical attention. If vomiting occurs, keep head lower than hips to prevent aspiration. Give artificial respiration, if not breathing, by qualified personnel.

5. FIRE FIGHTING MEASURES

Fire and Explosion Hazards: Asbestiform Riebeckite

Extinguishing Media: Regular dry chemical. Carbon dioxide. Water. Regular foam.

Fire Fighting: If material is involved in a fire, extinguish fire with a medium appropriate for the surrounding fire. Material itself does NOT burn or burns with difficulty. Keep run-off water out of sewers and water sources. Wear full protective clothing and NIOSH-approved self-contained breathing apparatus (SCBA).

Component: Asbestiform Riebeckite

Flash Point: Not applicable.

Method Used: Not applicable.

Autoignition Temp.: Not applicable.

Flammability Limits in Air

UPPER (Volume %): Not applicable.

LOWER (Volume %): Not applicable.

6. ACCIDENTAL RELEASE MEASURES

Occupational Release: Do NOT touch or walk through spilled material. Avoid inhalation of asbestos dust (see Section 8, "Exposure Controls and Personal Protection"). Collect small dry spills with a shovel and place material into an appropriate container for disposal. Prevent entry into waterways and sewers. Clean up residue with a HEPA filter vacuum.

Disposal: Refer to Section 13, "Disposal Considerations".

7. HANDLING AND STORAGE

Storage:	Store and handle in accordance with all current regulations and standards. Store in a cool, dry place.
Safe Handling Precautions:	See Section 8, "Exposure Controls and Personal Protection".

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Exposure Limits:	Asbestiform Riebeckite OSHA (PEL): 0.1 fibers/cc TWA ACGIH (TLV): 0.1 fibers/cc TWA NIOSH: 0.1 fibers/cc recommended TWA (10 h)
Ventilation:	Provide local exhaust ventilation system equipped with HEPA-filter dust collection system.
Respirator:	If workplace conditions warrant a respirator's use, a NIOSH/MSHA approved respirator should be used under an implemented respiratory protection program in accordance with OSHA Standard 29 CFR 1910.134 (General Industry, Use of Respirators) and 29 CFR 1910.1001 for occupational exposure to asbestos.
Eye Protection:	Wear safety goggles. An eye wash station should be readily available near areas of use.
Personal Protection:	Wear appropriate protective clothing and gloves to prevent skin exposure. Refer to OSHA Regulated Substances: OSHA 29 CFR 1910.1001.

9. PHYSICAL AND CHEMICAL PROPERTIES

Component:	Asbestiform Riebeckite
Appearance:	Fibrous solid to dust-like powder. Blue to purple color. Odorless.
Molecular Formula:	$\text{Na}_2(\text{Fe}^{2+}_3\text{Fe}^{3+}_2)(\text{Si}_8\text{O}_{22})(\text{OH})_2$
Water Solubility:	Insoluble.

10. STABILITY AND REACTIVITY

Stability:	<u> X </u> Stable <u> </u> Unstable Stable at normal temperatures and pressure.
Conditions to Avoid:	Avoid generating dust. Keep out of water supplies and sewers.
Incompatible Materials:	May be attacked by strong acids.
Fire/Explosion Information:	See Section 5, "Fire Fighting Measures".
Hazardous Decomposition:	Completely decomposes at temperatures of 1 000 °C.
Hazardous Polymerization:	<u> </u> Will Occur <u> X </u> Will Not Occur

11. TOXICOLOGICAL INFORMATION

Route of Entry:	<u> X </u> Inhalation <u> X </u> Skin <u> X </u> Ingestion
Toxicity Data:	Asbestiform Riebeckite Rat, Intraperitoneal LD ₅₀ : 300 mg/kg Rat, Inhalation-Intermittent TC _{LO} : 7 200 µg/m ³ (6 h – 20 days) Rat, Inhalation-Intermittent TC _{LO} : 13 600 µg/m ³ (6 h – 5 days)
Tumorigenic, Reproductive, Mutagenic Data:	Riebeckite asbestos has been investigated as a tumorigenic and mutagenic effector.
Health Effects (Acute and Chronic):	See Section 3: "Hazards Identification" for potential health effects.

12. ECOLOGICAL INFORMATION

Ecotoxicity Data: Not available.

13. DISPOSAL CONSIDERATIONS

Waste Disposal: Dispose in accordance with all applicable federal, state, and local regulations.

14. TRANSPORTATION INFORMATION

U.S. DOT and IATA: **U.S. DOT and IATA:** Asbestos; UN2212; Hazard Class 9
NOTE: This material, as packaged for SRM 1866b, is not subject to the regulations per DOT Special Provision 156 and IATA special Provision A61.

15. REGULATORY INFORMATION

U.S. Regulations: CERCLA Sections 102a/103 (40 CFR 302.4): Asbestos: 1 lbs RQ.
SARA Title III Section 302 (40 CFR 355.30): Not regulated.
SARA Title III Section 304 (40 CFR 355.40): Not regulated.
SARA Title III Section 313 (40 CFR 372.65): Asbestos.
OSHA Process Safety (29 CFR 1910.119): Not regulated.
SARA Title III Sections 311/312 Hazardous Categories (40 CFR 370.21):

ACUTE: No.
CHRONIC: Yes.
FIRE: No.
REACTIVE: No.
SUDDEN RELEASE: No.

State Regulations: California Proposition 65: Asbestos is known to the state of California to cause cancer (Feb. 27, 1987)

CANADIAN Regulations
WHMIS Classification: Not determined.

EUROPEAN Regulations
EC Classification (assigned): T Toxicity.
Carcinogen Category 1.

EC Risk Phrases: R45 May cause cancer.
R23/48 Toxic: danger of serious damage to health by prolonged exposure through inhalation.

EC Safety Phrases: S45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
S53 Avoid exposure.

National Inventory Status

U.S. Inventory (TSCA): Asbestos: Not listed on inventory.

TSCA 12(b)
Export Notification: Asbestos: CAS No. 1332-21-4
Section 6

16. OTHER INFORMATION

Sources: MDL Information Systems, Inc., MSDS *Crocidolite*, 14 September 2006.

Disclaimer: Physical and chemical data contained in this MSDS are provided only for use as a guide in assessing the hazardous nature of the material. The MSDS was prepared carefully, using current references; however, NIST does not certify the data in the MSDS. The certified values for this material are given in the NIST Certificate of Analysis.

**Benzene**

Version 1.9

Revision Date 2016-01-08

SECTION 1: Identification of the substance/mixture and of the company/undertaking**Product information**

Product Name : Benzene
Material : 1098293, 1059192, 1059060, 1037212, 1037213, 1037103,
1029170, 1037104, 1015526, 1016960

Company : Chevron Phillips Chemical Company LP
10001 Six Pines Drive
The Woodlands, TX 77380

Emergency telephone:**Health:**

866.442.9628 (North America)

1.832.813.4984 (International)

Transport:

CHEMTREC 1.800.424.9300 (within USA and Canada) or 703.527.3887 (outside USA and Canada)

Asia: +800 CHEMCALL (+800 2436 2255) China: +86-21-22157316

EUROPE: BIG +32.14.584545 (phone) or +32.14583516 (telefax)

South America SOS-Cotec Inside Brazil: 0800.111.767 Outside Brazil: +55.19.3467.1600

Responsible Department : Product Safety and Toxicology Group
E-mail address : SDS@CPChem.com
Website : www.CPChem.com

SECTION 2: Hazards identification**Classification of the substance or mixture**

This product has been classified in accordance with the hazard communication standard 29 CFR 1910.1200; the SDS and labels contain all the information as required by the standard.

Emergency Overview**Danger****Physical state:** Liquid **Color:** Clear, Colorless **Odor:** sweet, distinct

OSHA Hazards : Flammable Liquid, Aspiration hazard, Carcinogen, Moderate skin irritant, Moderate eye irritant, Mutagen, Target Organ Effects

Classification

Benzene

Version 1.9

Revision Date 2016-01-08

- : Flammable liquids , Category 2
- Skin irritation , Category 2
- Eye irritation , Category 2A
- Germ cell mutagenicity , Category 1B
- Carcinogenicity , Category 1A
- Specific target organ systemic toxicity - repeated exposure , Category 1 , Blood
- Aspiration hazard , Category 1

Labeling

Symbol(s)



Signal Word

: Danger

Hazard Statements

- : H225: Highly flammable liquid and vapor.
- H304: May be fatal if swallowed and enters airways.
- H315: Causes skin irritation.
- H319: Causes serious eye irritation.
- H340: May cause genetic defects.
- H350: May cause cancer.
- H372: Causes damage to organs (Blood) through prolonged or repeated exposure.

Precautionary Statements

- : **Prevention:**
- P201 Obtain special instructions before use.
- P202 Do not handle until all safety precautions have been read and understood.
- P210 Keep away from heat/sparks/open flames/hot surfaces. No smoking.
- P233 Keep container tightly closed.
- P240 Ground/bond container and receiving equipment.
- P241 Use explosion-proof electrical/ ventilating/ lighting/ equipment.
- P242 Use only non-sparking tools.
- P243 Take precautionary measures against static discharge.
- P260 Do not breathe dust/fume/gas/mist/vapor/spray.
- P264 Wash skin thoroughly after handling.
- P270 Do not eat, drink or smoke when using this product.
- P280 Wear protective gloves/ eye protection/ face protection.
- P281 Use personal protective equipment as required.
- Response:**
- P301 + P310 IF SWALLOWED: Immediately call a POISON CENTER or doctor/ physician.
- P303 + P361 + P353 IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.
- P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
- P308 + P313 IF exposed or concerned: Get medical advice/ attention.
- P331 Do NOT induce vomiting.
- P332 + P313 If skin irritation occurs: Get medical advice/ attention.
- P337 + P313 If eye irritation persists: Get medical advice/

Benzene

Version 1.9

Revision Date 2016-01-08

attention.

P362 Take off contaminated clothing and wash before reuse.

P370 + P378 In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.

Storage:

P403 + P235 Store in a well-ventilated place. Keep cool.

P405 Store locked up.

Disposal:

P501 Dispose of contents/ container to an approved waste disposal plant.

Carcinogenicity:**IARC**

Group 1: Carcinogenic to humans

Benzene 71-43-2

NTP

Known to be human carcinogen

Benzene 71-43-2

ACGIH

Confirmed human carcinogen

Benzene 71-43-2

SECTION 3: Composition/information on ingredients

Synonyms : Aromatic Benzene
Benzol
Cyclohexatriene
Phene
Phenyl Hydride

Molecular formula : C₆H₆

Component	CAS-No.	Weight %
Benzene	71-43-2	100

SECTION 4: First aid measures

General advice : Move out of dangerous area. Show this material safety data sheet to the doctor in attendance. Material may produce a serious, potentially fatal pneumonia if swallowed or vomited.

If inhaled : If unconscious place in recovery position and seek medical advice. If symptoms persist, call a physician.

In case of skin contact : If skin irritation persists, call a physician. If on skin, rinse well with water. If on clothes, remove clothes.

In case of eye contact : Immediately flush eye(s) with plenty of water. Remove contact lenses. Protect unharmed eye. Keep eye wide open while rinsing. If eye irritation persists, consult a specialist.

If swallowed : Keep respiratory tract clear. Never give anything by mouth to an unconscious person. If symptoms persist, call a physician.

Benzene

Version 1.9

Revision Date 2016-01-08

Take victim immediately to hospital.

SECTION 5: Firefighting measures

Flash point	: -11 °C (12 °F) Method: Tag closed cup
Autoignition temperature	: 498 °C (928 °F)
Suitable extinguishing media	: Alcohol-resistant foam. Carbon dioxide (CO2). Dry chemical.
Unsuitable extinguishing media	: High volume water jet.
Specific hazards during fire fighting	: Do not allow run-off from fire fighting to enter drains or water courses.
Special protective equipment for fire-fighters	: Wear self-contained breathing apparatus for firefighting if necessary.
Further information	: Collect contaminated fire extinguishing water separately. This must not be discharged into drains. Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations. For safety reasons in case of fire, cans should be stored separately in closed containments. Use a water spray to cool fully closed containers.
Fire and explosion protection	: Do not spray on an open flame or any other incandescent material. Take necessary action to avoid static electricity discharge (which might cause ignition of organic vapors). Use only explosion-proof equipment. Keep away from open flames, hot surfaces and sources of ignition.
Hazardous decomposition products	: No data available.

SECTION 6: Accidental release measures

Personal precautions	: Use personal protective equipment. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapors accumulating to form explosive concentrations. Vapors can accumulate in low areas.
Environmental precautions	: Prevent product from entering drains. Prevent further leakage or spillage if safe to do so. If the product contaminates rivers and lakes or drains inform respective authorities.
Methods for cleaning up	: Contain spillage, and then collect with non-combustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and place in container for disposal according to local / national regulations (see section 13).

Benzene

Version 1.9

Revision Date 2016-01-08

SECTION 7: Handling and storage**Handling**

Advice on safe handling : Avoid formation of aerosol. Do not breathe vapors/dust. Avoid exposure - obtain special instructions before use. Avoid contact with skin and eyes. For personal protection see section 8. Smoking, eating and drinking should be prohibited in the application area. Provide sufficient air exchange and/or exhaust in work rooms. Container may be opened only under exhaust ventilation hood. Open drum carefully as content may be under pressure. Dispose of rinse water in accordance with local and national regulations.

Electrostatic charge may accumulate and create a hazardous condition when handling this material. To minimize this hazard, bonding and grounding may be necessary, but may not by themselves be sufficient. Review all operations, which have the potential to generating and accumulation of electrostatic charge and/or a flammable atmosphere (including tank and container filling, splash filling, tank cleaning, sampling, gauging, switch loading, filtering, mixing, agitation, and vacuum truck operations) and use appropriate mitigating procedures. For more information, refer to OSHA Standard 29 CFR 1910.106 "Flammable and Combustible Liquids"; National Fire Protection Association (NFPA 77), "Recommended Practice on Static Electricity"; and/or the American Petroleum Institute (API) Recommended Practice 2003, "Protection Against Ignitions Arising Out of Static, Lightning, and stray Currents".

Avoid formation of aerosol. Do not breathe vapors/dust. Avoid exposure - obtain special instructions before use. Avoid contact with skin and eyes. For personal protection see section 8. Smoking, eating and drinking should be prohibited in the application area. Take precautionary measures against static discharges. Provide sufficient air exchange and/or exhaust in work rooms. Container may be opened only under exhaust ventilation hood. Open drum carefully as content may be under pressure. Dispose of rinse water in accordance with local and national regulations.

Advice on protection against fire and explosion : Do not spray on an open flame or any other incandescent material. Take necessary action to avoid static electricity discharge (which might cause ignition of organic vapors). Use only explosion-proof equipment. Keep away from open flames, hot surfaces and sources of ignition.

Storage

Requirements for storage areas and containers : No smoking. Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage. Observe label precautions. Electrical installations / working materials must comply with the technological safety standards.

SECTION 8: Exposure controls/personal protection**Ingredients with workplace control parameters**

Benzene

Version 1.9

Revision Date 2016-01-08

US

Ingredients	Basis	Value	Control parameters	Note
Benzene	ACGIH	TWA	0.5 ppm,	BEI, A1, Skin,
	ACGIH	STEL	2.5 ppm,	BEI, A1, Skin,
	OSHA Z-1-A	TWA	1 ppm,	
	OSHA Z-1-A	CEIL	5 ppm,	
	OSHA Z-2	Peak	50 ppm,	(a),
	OSHA 29 CFR 1910.1028(c)	TWA	1 ppm,	
	OSHA 29 CFR 1910.1028(c)	STEL	5 ppm,	
	OSHA CARC	PEL	1 ppm,	
	OSHA CARC	STEL	5 ppm,	

(a) This standard applies to the industry segments exempt from the 1 ppm 8-hour TWA and 5 ppm STEL of the benzene standard at 1910.1028.

A1 Confirmed human carcinogen

BEI Substances for which there is a Biological Exposure Index or Indices (see BEI® section)

Skin Danger of cutaneous absorption

Immediately Dangerous to Life or Health Concentrations (IDLH)

Substance name	CAS-No.	Control parameters	Update
Benzene	71-43-2	Immediately Dangerous to Life or Health Concentration Value 500 ppm	1995-03-01

Engineering measures

Adequate ventilation to control airborne concentrations below the exposure guidelines/limits. Consider the potential hazards of this material (see Section 2), applicable exposure limits, job activities, and other substances in the work place when designing engineering controls and selecting personal protective equipment. If engineering controls or work practices are not adequate to prevent exposure to harmful levels of this material, the personal protective equipment listed below is recommended. The user should read and understand all instructions and limitations supplied with the equipment since protection is usually provided for a limited time or under certain circumstances.

Personal protective equipment

- Respiratory protection : Wear a supplied-air NIOSH approved respirator unless ventilation or other engineering controls are adequate to maintain minimal oxygen content of 19.5% by volume under normal atmospheric pressure. Wear a NIOSH approved respirator that provides protection when working with this material if exposure to harmful levels of airborne material may occur, such as: Air-Purifying Respirator for Organic Vapors. Use a positive pressure, air-supplying respirator if there is potential for uncontrolled release, exposure levels are not known, or other circumstances where air-purifying respirators may not provide adequate protection.
- Hand protection : The suitability for a specific workplace should be discussed with the producers of the protective gloves. Please observe the instructions regarding permeability and breakthrough time which are provided by the supplier of the gloves. Also take into consideration the specific local conditions under which the product is used, such as the danger of cuts, abrasion, and the contact time. Gloves should be discarded and replaced if there is any indication of degradation or chemical breakthrough.
- Eye protection : Eye wash bottle with pure water. Tightly fitting safety goggles.
- Skin and body protection : Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the specific work-place. Wear as appropriate: Flame retardant

Benzene

Version 1.9

Revision Date 2016-01-08

antistatic protective clothing. Workers should wear antistatic footwear.

Hygiene measures : When using do not eat or drink. When using do not smoke. Wash hands before breaks and at the end of workday.

SECTION 9: Physical and chemical properties**Information on basic physical and chemical properties****Appearance**

Physical state : Liquid
Color : Clear, Colorless
Odor : sweet, distinct

Safety data

Flash point : -11 °C (12 °F)
Method: Tag closed cup

Lower explosion limit : 1.2 %(V)

Upper explosion limit : 7.8 %(V)

Oxidizing properties : no

Autoignition temperature : 498 °C (928 °F)

Molecular formula : C₆H₆

Molecular weight : 78.12 g/mol

pH : Not applicable

Pour point : No data available

Boiling point/boiling range : 80 °C (176 °F)

Vapor pressure : 75.00 MMHG
at 20 °C (68 °F)

Relative density : 0.88
at 25 °C (77 °F)

Water solubility : 1.88 g/l
at 23.5 °C (74.3 °F)

Partition coefficient: n-octanol/water : log Pow: 2.13

Relative vapor density : 2.77
(Air = 1.0)

Evaporation rate : 2.8

Percent volatile : > 99 %

Other information

Benzene

Version 1.9

Revision Date 2016-01-08

Conductivity : < 50 pSm
at 20 °C

SECTION 10: Stability and reactivity

Reactivity : No decomposition if stored and applied as directed.

Chemical stability : This material is considered stable under normal ambient and anticipated storage and handling conditions of temperature and pressure.
No decomposition if stored and applied as directed.

Possibility of hazardous reactions

Conditions to avoid : Heat, flames and sparks.

Materials to avoid : May react with oxygen and strong oxidizing agents, such as chlorates, nitrates, peroxides, etc.

Hazardous decomposition products : No data available

Other data : No decomposition if stored and applied as directed.

SECTION 11: Toxicological information**Acute oral toxicity**

Benzene : LD50: > 2,000 mg/kg
Species: Rat
Sex: female

Acute inhalation toxicity

Benzene : LC50: 44.5 mg/l
Exposure time: 4 h
Species: Rat
Sex: Not Specified
Test atmosphere: vapor

Acute dermal toxicity

Benzene : LD50: > 8,260 mg/kg
Species: Rabbit

Benzene

Skin irritation : May cause skin irritation in susceptible persons.

Benzene

Eye irritation : May cause irreversible eye damage.

Sensitization

Benzene

Version 1.9

Revision Date 2016-01-08

Benzene : Did not cause sensitization on laboratory animals.

Repeated dose toxicity

Benzene : Species: Rat, female
Sex: female
Application Route: oral gavage
Dose: 0, 25, 50, 100 mg/kg
Exposure time: 103 wk
Number of exposures: 5 d/wk
NOEL: < 25 mg/kg
Lowest observable effect level: 25 mg/kg

Species: Rat, male
Sex: male
Application Route: oral gavage
Dose: 0, 50, 100, 200 mg/kg
Exposure time: 103 wk
Number of exposures: 5 d/wk
NOEL: < 50 mg/kg
Lowest observable effect level: 50 mg/kg

Species: Mouse
Application Route: oral gavage
Dose: 0, 25, 50, 100 mg/kg
Exposure time: 103 wk
NOEL: < 25 mg/kg

Carcinogenicity

Benzene : Species: Rat
Sex: female
Dose: 0, 25, 50, 250 mg/kg
Exposure time: 103 wks
Number of exposures: daily, 5 days/week
Test substance: yes
Remarks: zymbal gland carcinomas, squamous cell papillomas

Species: Rat
Sex: male
Dose: 0, 50, 100, 200 mg/kg
Exposure time: 103 wks
Number of exposures: daily, 5 days/week
Test substance: yes
Remarks: zymbal gland carcinomas, squamous cell papillomas

Species: Mouse
Sex: male and female
Dose: 25, 50, 100 mg/kg
Exposure time: 103 wks
Number of exposures: daily, 5 days/week
Test substance: yes
Remarks: Clear evidence of multiple organ carcinogenicity.

Benzene

Aspiration toxicity : May be fatal if swallowed and enters airways.

Benzene

Version 1.9

Revision Date 2016-01-08

Substances known to cause human aspiration toxicity hazards or to be regarded as if they cause human aspiration toxicity hazard.

CMR effects

Benzene : Carcinogenicity: Human carcinogen.
 Mutagenicity: In vivo tests showed mutagenic effects
 Teratogenicity: Did not show teratogenic effects in animal experiments.
 Reproductive toxicity: Animal testing did not show any effects on fertility.

Benzene**Further information**

: Chronic Health Hazard.
 Solvents may degrease the skin.

SECTION 12: Ecological information**Toxicity to fish**

Benzene : LC50: 5.3 mg/l
 Exposure time: 96 h
 Species: Oncorhynchus mykiss (rainbow trout)
 flow-through test Test substance: yes
 Method: OECD Test Guideline 203

Toxicity to daphnia and other aquatic invertebrates

Benzene : EC50: 10 mg/l
 Exposure time: 48 h
 Species: Daphnia magna (Water flea)
 static test Test substance: yes
 Method: OECD Test Guideline 202

Toxicity to algae

Benzene : ErC50: 100 mg/l
 Exposure time: 72 h
 Species: Pseudokirchneriella subcapitata (green algae)
 Test substance: yes
 Method: OECD Test Guideline 201

Elimination information (persistence and degradability)

Biodegradability : This material is expected to be readily biodegradable.

Ecotoxicology Assessment

Acute aquatic toxicity

Benzene : Toxic to aquatic life.

Chronic aquatic toxicity

Benzene : Harmful to aquatic life with long lasting effects.

Benzene

Version 1.9

Revision Date 2016-01-08

Results of PBT assessment

Benzene

: This substance is not considered to be persistent, bioaccumulating and toxic (PBT)., This substance is not considered to be very persistent and very bioaccumulating (vPvB).

Additional ecological information

: Toxic to aquatic life.

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal., Toxic to aquatic life.

SECTION 13: Disposal considerations

The information in this SDS pertains only to the product as shipped.

Use material for its intended purpose or recycle if possible. This material, if it must be discarded, may meet the criteria of a hazardous waste as defined by US EPA under RCRA (40 CFR 261) or other State and local regulations. Measurement of certain physical properties and analysis for regulated components may be necessary to make a correct determination. If this material is classified as a hazardous waste, federal law requires disposal at a licensed hazardous waste disposal facility.

Product

: The product should not be allowed to enter drains, water courses or the soil. Do not contaminate ponds, waterways or ditches with chemical or used container. Send to a licensed waste management company.

Contaminated packaging

: Empty remaining contents. Dispose of as unused product. Do not re-use empty containers. Do not burn, or use a cutting torch on, the empty drum.

SECTION 14: Transport information

The shipping descriptions shown here are for bulk shipments only, and may not apply to shipments in non-bulk packages (see regulatory definition).

Consult the appropriate domestic or international mode-specific and quantity-specific Dangerous Goods Regulations for additional shipping description requirements (e.g., technical name or names, etc.) Therefore, the information shown here, may not always agree with the bill of lading shipping description for the material. Flashpoints for the material may vary slightly between the SDS and the bill of lading.

US DOT (UNITED STATES DEPARTMENT OF TRANSPORTATION)

UN1114, BENZENE, 3, II, RQ (BENZENE)

IMO / IMDG (INTERNATIONAL MARITIME DANGEROUS GOODS)

UN1114, BENZENE, 3, II, (-11 °C)

IATA (INTERNATIONAL AIR TRANSPORT ASSOCIATION)

UN1114, BENZENE, 3, II

ADR (AGREEMENT ON DANGEROUS GOODS BY ROAD (EUROPE))

Benzene

Version 1.9

Revision Date 2016-01-08

UN1114, BENZENE, 3, II, (D/E)

RID (REGULATIONS CONCERNING THE INTERNATIONAL TRANSPORT OF DANGEROUS GOODS (EUROPE))

UN1114, BENZENE, 3, II

ADN (EUROPEAN AGREEMENT CONCERNING THE INTERNATIONAL CARRIAGE OF DANGEROUS GOODS BY INLAND WATERWAYS)

UN1114, BENZENE, 3, II

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Other information	: Benzene and mixtures having 10% Benzene or more, S.T. 3, Cat.Y
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SECTION 15: Regulatory information**National legislation**

CERCLA Reportable Quantity : 10 lbs
Benzene

SARA 302 Reportable Quantity : This material does not contain any components with a SARA 302 RQ.

SARA 302 Threshold Planning Quantity : No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 304 Reportable Quantity : This material does not contain any components with a section 304 EHS RQ.

SARA 313 Ingredients : The following components are subject to reporting levels established by SARA Title III, Section 313:

: Benzene - 71-43-2

Clean Air Act

Ozone-Depletion Potential : This product neither contains, nor was manufactured with a Class I or Class II ODS as defined by the U.S. Clean Air Act Section 602 (40 CFR 82, Subpt. A, App.A + B).

The following chemical(s) are listed as HAP under the U.S. Clean Air Act, Section 12 (40 CFR 61):

Benzene

Version 1.9

Revision Date 2016-01-08

: Benzene - 71-43-2

This product does not contain any chemicals listed under the U.S. Clean Air Act Section 112(r) for Accidental Release Prevention (40 CFR 68.130, Subpart F).

The following chemical(s) are listed under the U.S. Clean Air Act Section 111 SOCM I Intermediate or Final VOC's (40 CFR 60.489):

: Benzene - 71-43-2

US State Regulations

Pennsylvania Right To Know

: Benzene - 71-43-2

New Jersey Right To Know

: Benzene - 71-43-2

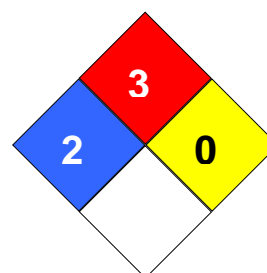
California Prop. 65
Ingredients

: WARNING! This product contains a chemical known in the State of California to cause cancer.

WARNING: This product contains a chemical known in the State of California to cause birth defects or other reproductive harm.

Notification status

Europe REACH	:	On the inventory, or in compliance with the inventory
United States of America TSCA	:	On the inventory, or in compliance with the inventory
Canada DSL	:	On the inventory, or in compliance with the inventory
Australia AICS	:	On the inventory, or in compliance with the inventory
New Zealand NZIoC	:	On the inventory, or in compliance with the inventory
Japan ENCS	:	On the inventory, or in compliance with the inventory
Korea KECI	:	On the inventory, or in compliance with the inventory
Philippines PICCS	:	On the inventory, or in compliance with the inventory
China IECSC	:	On the inventory, or in compliance with the inventory

SECTION 16: Other information**NFPA Classification**: Health Hazard: 2
Fire Hazard: 3
Reactivity Hazard: 0

Benzene

Version 1.9

Revision Date 2016-01-08

Further information

Legacy SDS Number : CPC00091

Significant changes since the last version are highlighted in the margin. This version replaces all previous versions.

The information in this SDS pertains only to the product as shipped.

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

Key or legend to abbreviations and acronyms used in the safety data sheet

ACGIH	American Conference of Government Industrial Hygienists	LD50	Lethal Dose 50%
AICS	Australia, Inventory of Chemical Substances	LOAEL	Lowest Observed Adverse Effect Level
DSL	Canada, Domestic Substances List	NFPA	National Fire Protection Agency
NDSL	Canada, Non-Domestic Substances List	NIOSH	National Institute for Occupational Safety & Health
CNS	Central Nervous System	NTP	National Toxicology Program
CAS	Chemical Abstract Service	NZIoC	New Zealand Inventory of Chemicals
EC50	Effective Concentration	NOAEL	No Observable Adverse Effect Level
EC50	Effective Concentration 50%	NOEC	No Observed Effect Concentration
EGEST	EOSCA Generic Exposure Scenario Tool	OSHA	Occupational Safety & Health Administration
EOSCA	European Oilfield Specialty Chemicals Association	PEL	Permissible Exposure Limit
EINECS	European Inventory of Existing Chemical Substances	PICCS	Philippines Inventory of Commercial Chemical Substances
MAK	Germany Maximum Concentration Values	PRNT	Presumed Not Toxic
GHS	Globally Harmonized System	RCRA	Resource Conservation Recovery Act
>=	Greater Than or Equal To	STEL	Short-term Exposure Limit
IC50	Inhibition Concentration 50%	SARA	Superfund Amendments and Reauthorization Act.
IARC	International Agency for Research on Cancer	TLV	Threshold Limit Value
IECSC	Inventory of Existing Chemical Substances in China	TWA	Time Weighted Average
ENCS	Japan, Inventory of Existing and New Chemical Substances	TSCA	Toxic Substance Control Act
KECI	Korea, Existing Chemical Inventory	UVCB	Unknown or Variable Composition, Complex Reaction Products, and Biological Materials
<=	Less Than or Equal To	WHMIS	Workplace Hazardous Materials Information System
LC50	Lethal Concentration 50%		

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Product form : Substance
Substance name : Toluene
CAS No : 108-88-3
Product code : LC26170
Formula : C₇H₈
Synonyms : benzyl hydride / methylbenzene / phenylmethane / tolunol / toluol oil / toluole
BIG no : 10046

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/mixture : Solvent

1.3. Details of the supplier of the safety data sheet

LabChem Inc
Jackson's Pointe Commerce Park Building 1000, 1010 Jackson's Pointe Court
Zelienople, PA 16063 - USA
T 412-826-5230 - F 724-473-0647
info@labchem.com - www.labchem.com

1.4. Emergency telephone number

Emergency number : CHEMTREC: 1-800-424-9300 or 011-703-527-3887

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

GHS-US classification

Flam. Liq. 2 H225
Skin Irrit. 2 H315
Repr. 2 H361
STOT SE 3 H336
STOT RE 2 H373
Asp. Tox. 1 H304

2.2. Label elements

GHS-US labelling

Hazard pictograms (GHS-US)



GHS02

GHS07

GHS08

Signal word (GHS-US)

: Danger

Hazard statements (GHS-US)

: H225 - Highly flammable liquid and vapour
H304 - May be fatal if swallowed and enters airways
H315 - Causes skin irritation
H336 - May cause drowsiness or dizziness
H361 - Suspected of damaging fertility or the unborn child
H373 - May cause damage to organs through prolonged or repeated exposure

Precautionary statements (GHS-US)

: P201 - Obtain special instructions before use
P202 - Do not handle until all safety precautions have been read and understood
P210 - Keep away from heat, sparks, open flames, hot surfaces. - No smoking
P233 - Keep container tightly closed
P240 - Ground/bond container and receiving equipment
P241 - Use explosion-proof electrical, ventilating, lighting equipment
P242 - Use only non-sparking tools
P243 - Take precautionary measures against static discharge
P260 - Do not breathe mist, vapours, spray
P264 - Wash exposed skin thoroughly after handling
P271 - Use only outdoors or in a well-ventilated area
P280 - Wear protective gloves, protective clothing, eye protection, face protection

Toluene

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

P301+P310 - IF SWALLOWED: immediately call a POISON CENTER or doctor/physician
P303+P361+P353 - IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower
P304+P340 - IF INHALED: remove victim to fresh air and keep at rest in a position comfortable for breathing
P308+P313 - IF exposed or concerned: Get medical advice/attention
P331 - If swallowed, do NOT induce vomiting
P332+P313 - If skin irritation occurs: Get medical advice/attention
P362 - Take off contaminated clothing and wash before reuse
P370+P378 - In case of fire: Use carbon dioxide (CO₂), powder, alcohol-resistant foam for extinction
P403+P233 - Store in a well-ventilated place. Keep container tightly closed
P405 - Store locked up
P501 - Dispose of contents/container to comply with local, state and federal regulations
P235 - Keep cool

2.3. Other hazards

Other hazards not contributing to the classification : None under normal conditions.

2.4. Unknown acute toxicity (GHS-US)

No data available

SECTION 3: Composition/information on ingredients

3.1. Substance

Substance type : Mono-constituent

Name	Product identifier	%	GHS-US classification
Toluene (Main constituent)	(CAS No) 108-88-3	100	Flam. Liq. 2, H225 Skin Irrit. 2, H315 Repr. 2, H361 STOT SE 3, H336 STOT RE 2, H373 Asp. Tox. 1, H304

Full text of H-phrases: see section 16

3.2. Mixture

Not applicable

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures general : Check the vital functions. Unconscious: maintain adequate airway and respiration. Respiratory arrest: artificial respiration or oxygen. Cardiac arrest: perform resuscitation. Victim conscious with laboured breathing: half-seated. Victim in shock: on his back with legs slightly raised. Vomiting: prevent asphyxia/aspiration pneumonia. Prevent cooling by covering the victim (no warming up). Keep watching the victim. Give psychological aid. Keep the victim calm, avoid physical strain. Depending on the victim's condition: doctor/hospital. Never give alcohol to drink.

First-aid measures after inhalation : Remove the victim into fresh air. Respiratory problems: consult a doctor/medical service.

First-aid measures after skin contact : Wash immediately with lots of water. Soap may be used. Do not apply (chemical) neutralizing agents. Remove clothing before washing. Take victim to a doctor if irritation persists.

First-aid measures after eye contact : Rinse immediately with plenty of water. Do not apply neutralizing agents. Take victim to an ophthalmologist if irritation persists.

First-aid measures after ingestion : Rinse mouth with water. Immediately after ingestion: give lots of water to drink. Do not give milk/oil to drink. Do not induce vomiting. Give activated charcoal. Call Poison Information Centre (www.big.be/antigif.htm). Consult a doctor/medical service if you feel unwell. Ingestion of large quantities: immediately to hospital.

4.2. Most important symptoms and effects, both acute and delayed

Symptoms/injuries after inhalation : EXPOSURE TO HIGH CONCENTRATIONS: Headache. Nausea. Feeling of weakness. Dizziness. Central nervous system depression. Narcosis. Mental confusion. Drunkenness. Coordination disorders. Disturbed motor response. Disturbances of consciousness.

Symptoms/injuries after skin contact : Tingling/irritation of the skin.

Symptoms/injuries after eye contact : Irritation of the eye tissue.

Symptoms/injuries after ingestion : Risk of aspiration pneumonia. Nausea. Abdominal pain. Symptoms similar to those listed under inhalation.

Toluene

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

Chronic symptoms : ON CONTINUOUS/REPEATED EXPOSURE/CONTACT: Dry skin. Skin rash/inflammation. Impairment of the nervous system. Tremor. Impaired memory. Impaired concentration. Brain affection. Disturbances of heart rate. Change in the haemogramme/blood composition.

4.3. Indication of any immediate medical attention and special treatment needed

Obtain medical assistance.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media : Preferably: alcohol resistant foam. Water spray. BC powder. Polyvalent foam. AFFF foam. Carbon dioxide.

Unsuitable extinguishing media : Container may slop over if solid jet (water/foam) is applied.

5.2. Special hazards arising from the substance or mixture

Fire hazard : DIRECT FIRE HAZARD. Highly flammable. Gas/vapour flammable with air within explosion limits. INDIRECT FIRE HAZARD. May build up electrostatic charges: risk of ignition. May be ignited by sparks. Gas/vapour spreads at floor level: ignition hazard. Reactions involving a fire hazard: see "Reactivity Hazard".

Explosion hazard : DIRECT EXPLOSION HAZARD. Gas/vapour explosive with air within explosion limits. INDIRECT EXPLOSION HAZARD. may be ignited by sparks. Reactions with explosion hazards: see "Reactivity Hazard".

Reactivity : Upon combustion: CO and CO₂ are formed. Reacts violently with (some) halogens. Reacts violently with (strong) oxidizers: (increased) risk of fire/explosion. Violent to explosive reaction with (some) acids.

5.3. Advice for firefighters

Firefighting instructions : Cool tanks/drums with water spray/remove them into safety. Do not move the load if exposed to heat.

Protection during firefighting : Heat/fire exposure: compressed air/oxygen apparatus.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

6.1.1. For non-emergency personnel

Protective equipment : Gloves. Protective goggles. Head/neck protection. Protective clothing. Large spills/in enclosed spaces: compressed air apparatus. Large spills/in enclosed spaces: gas-tight suit.

Emergency procedures : Keep upwind. Mark the danger area. Consider evacuation. Seal off low-lying areas. Close doors and windows of adjacent premises. Stop engines and no smoking. No naked flames or sparks. Spark- and explosionproof appliances and lighting equipment. Keep containers closed. Wash contaminated clothes.

6.1.2. For emergency responders

Protective equipment : Do not breathe gas, fumes, vapour or spray. Equip cleanup crew with proper protection.

Emergency procedures : Stop leak if safe to do so. Ventilate area. If a major spill occurs, all personnel should be immediately evacuated and the area ventilated.

6.2. Environmental precautions

Prevent soil and water pollution.

6.3. Methods and material for containment and cleaning up

For containment : Contain released substance, pump into suitable containers. Consult "Material-handling" to select material of containers. Plug the leak, cut off the supply. Dam up the liquid spill. Try to reduce evaporation. Measure the concentration of the explosive gas-air mixture. Dilute/disperse combustible gas/vapour with water curtain. Provide equipment/receptacles with earthing. Do not use compressed air for pumping over spills.

Methods for cleaning up : Liquid spill: cover with foam. Take up liquid spill into inert absorbent material, e.g.: sand, earth, vermiculite. Scoop absorbed substance into closing containers. See "Material-handling" for suitable container materials. Carefully collect the spill/leftovers. Damaged/cooled tanks must be emptied. Do not use compressed air for pumping over spills. Take collected spill to manufacturer/competent authority. Wash clothing and equipment after handling.

6.4. Reference to other sections

No additional information available

Toluene

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

SECTION 7: Handling and storage

7.1. Precautions for safe handling

- Precautions for safe handling : Comply with the legal requirements. Remove contaminated clothing immediately. Clean contaminated clothing. Handle uncleaned empty containers as full ones. Thoroughly clean/dry the installation before use. Do not discharge the waste into the drain. Do not use compressed air for pumping over. Use spark-/explosionproof appliances and lighting system. Take precautions against electrostatic charges. Keep away from naked flames/heat. Keep away from ignition sources/sparks. Observe strict hygiene. Keep container tightly closed. Measure the concentration in the air regularly. Work under local exhaust/ventilation.
- Hygiene measures : Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work. Do not eat, drink or smoke when using this product.

7.2. Conditions for safe storage, including any incompatibilities

- Incompatible products : Strong oxidizers.
- Incompatible materials : Direct sunlight. Heat sources. Sources of ignition.
- Heat and ignition sources : KEEP SUBSTANCE AWAY FROM: heat sources. ignition sources.
- Prohibitions on mixed storage : KEEP SUBSTANCE AWAY FROM: oxidizing agents. (strong) acids. halogens.
- Storage area : Store at ambient temperature. Ventilation at floor level. Fireproof storeroom. Provide for a tub to collect spills. Provide the tank with earthing. Under a shelter/in the open. Store only in a limited quantity. May be stored under nitrogen. Meet the legal requirements. Keep out of direct sunlight.
- Special rules on packaging : SPECIAL REQUIREMENTS: closing. clean. correctly labelled. meet the legal requirements. Secure fragile packagings in solid containers.
- Packaging materials : SUITABLE MATERIAL: metal. stainless steel. carbon steel. aluminium. nickel. polypropylene. glass. tin. MATERIAL TO AVOID: polyethylene.

7.3. Specific end use(s)

No additional information available

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Toluene (108-88-3)		
USA ACGIH	ACGIH TWA (ppm)	20 ppm
USA ACGIH	ACGIH STEL (ppm)	20 ppm
USA OSHA	OSHA PEL (TWA) (ppm)	200 ppm
USA OSHA	OSHA PEL (STEL) (ppm)	500 ppm 10-min peak per 8 hour shift
USA OSHA	OSHA PEL (Ceiling) (ppm)	300 ppm

8.2. Exposure controls

- Appropriate engineering controls : Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure. Ensure adequate ventilation.
- Materials for protective clothing : GIVE EXCELLENT RESISTANCE: No data available. GIVE GOOD RESISTANCE: tetrafluoroethylene. viton. PVA. GIVE LESS RESISTANCE: butyl rubber. natural rubber. neoprene. nitrile rubber. polyethylene. neoprene/natural rubber. nitrile rubber/PVC. GIVE POOR RESISTANCE: chloroprene rubber.
- Hand protection : Gloves.
- Eye protection : Safety glasses.
- Skin and body protection : Head/neck protection. Protective clothing.
- Respiratory protection : Wear gas mask with filter type A if conc. in air > exposure limit.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

- Physical state : Liquid
- Appearance : Liquid.
- Molecular mass : 92.14 g/mol
- Colour : Colourless.
- Odour : Aromatic odour.
- Odour threshold : 0.2 - 69 ppm
0.8 - 276 mg/m³
- pH : No data available

Toluene

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

Relative evaporation rate (butylacetate=1)	: 2.24
Melting point	: -95 °C
Freezing point	: No data available
Boiling point	: 111 °C
Flash point	: 4 °C
Critical temperature	: 321 °C
Self ignition temperature	: 480 °C
Decomposition temperature	: No data available
Flammability (solid, gas)	: No data available
Vapour pressure	: 29 hPa
Vapour pressure at 50 °C	: 109 hPa
Critical pressure	: 41077 hPa
Relative vapour density at 20 °C	: 3.2
Relative density	: 0.87
Relative density of saturated gas/air mixture	: 1.6
Density	: 870 kg/m ³
Solubility	: Insoluble in water. Soluble in ethanol. Soluble in ether. Soluble in acetone. Soluble in chloroform. Soluble in carbondisulfide. Soluble in acetic acid. Soluble in ethylacetate. Soluble in petroleum spirit. Water: 0.05 g/100ml Ethanol: Complete Ether: Complete Acetone: > 10 g/100ml
Log Pow	: 2.73 (Experimental value; Other; 20 °C, Experimental value; Other; 20 °C, Experimental value; Other; 20 °C)
Log Kow	: No data available
Viscosity, kinematic	: 0.690 mm ² /s (20 °C)
Viscosity, dynamic	: 0.0006 Pa.s (20 °C)
Explosive properties	: No data available
Oxidising properties	: No data available
Explosive limits	: 1.3 - 7 vol % 46 - 270 g/m ³

9.2. Other information

Minimum ignition energy	: 0.3 mJ
Specific conductivity	: 1.0 pS/m
Saturation concentration	: 110 g/m ³
VOC content	: 100 %
Other properties	: Gas/vapour heavier than air at 20°C. Clear. Volatile. Substance has neutral reaction. May generate electrostatic charges.

SECTION 10: Stability and reactivity

10.1. Reactivity

Upon combustion: CO and CO₂ are formed. Reacts violently with (some) halogens. Reacts violently with (strong) oxidizers: (increased) risk of fire/explosion. Violent to explosive reaction with (some) acids.

10.2. Chemical stability

Stable under normal conditions.

10.3. Possibility of hazardous reactions

No additional information available

10.4. Conditions to avoid

Heat. Direct sunlight. Sparks. Open flame.

10.5. Incompatible materials

Strong oxidizers.

10.6. Hazardous decomposition products

Carbon dioxide. Carbon monoxide.

Toluene

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity : Not classified

Toluene (V)108-88-3	
LD50 oral rat	> 2000 mg/kg (5580 mg/kg bodyweight; Rat; Rat; Experimental value)
LD50 dermal rabbit	12223 mg/kg (>5000 mg/kg bodyweight; Rabbit; Rabbit; Experimental value; Other,>5000 mg/kg bodyweight; Rabbit; Rabbit; Experimental value; Other)
LC50 inhalation rat (mg/l)	> 20 mg/l/4h (Rat)

Skin corrosion/irritation : Causes skin irritation.

Serious eye damage/irritation : Not classified

Respiratory or skin sensitisation : Not classified

Germ cell mutagenicity : Not classified

Carcinogenicity : Not classified

Toluene (108-88-3)	
IARC group	3 - Not classifiable

Reproductive toxicity : Suspected of damaging fertility or the unborn child.

Specific target organ toxicity (single exposure) : May cause drowsiness or dizziness.

Specific target organ toxicity (repeated exposure) : May cause damage to organs through prolonged or repeated exposure.

Aspiration hazard : May be fatal if swallowed and enters airways.

Symptoms/injuries after inhalation : EXPOSURE TO HIGH CONCENTRATIONS: Headache. Nausea. Feeling of weakness. Dizziness. Central nervous system depression. Narcosis. Mental confusion. Drunkenness. Coordination disorders. Disturbed motor response. Disturbances of consciousness.

Symptoms/injuries after skin contact : Tingling/irritation of the skin.

Symptoms/injuries after eye contact : Irritation of the eye tissue.

Symptoms/injuries after ingestion : Risk of aspiration pneumonia. Nausea. Abdominal pain. Symptoms similar to those listed under inhalation.

Chronic symptoms : ON CONTINUOUS/REPEATED EXPOSURE/CONTACT: Dry skin. Skin rash/inflammation. Impairment of the nervous system. Tremor. Impaired memory. Impaired concentration. Brain affection. Disturbances of heart rate. Change in the haemogramme/blood composition.

Likely routes of exposure : Inhalation;Skin and eye contact

SECTION 12: Ecological information

12.1. Toxicity

Ecology - general : Classification concerning the environment: not applicable.

Ecology - air : TA-Luft Klasse 5.2.5/l.

Ecology - water : Fouling to shoreline. Ground water pollutant. Toxic to fishes. Toxic to invertebrates. Harmful to algae. Inhibits photosynthesis of algae. Harmful to bacteria. Taste alteration in fishes/aquatic organisms.

Toluene (108-88-3)	
LC50 fishes 1	24 mg/l 96 h; Salmo gairdneri (Oncorhynchus mykiss)
EC50 Daphnia 1	84 mg/l (24 h; Daphnia magna; Locomotor effect)
LC50 fish 2	13 mg/l (96 h; Lepomis macrochirus)
EC50 Daphnia 2	11.5 - 19.6 mg/l (48 h; Daphnia magna)
Threshold limit algae 1	> 400 mg/l (168 h; Scenedesmus quadricauda; Toxicity test)
Threshold limit algae 2	105 mg/l (192 h; Microcystis aeruginosa)

12.2. Persistence and degradability

Toluene (108-88-3)	
Persistence and degradability	Readily biodegradable in water. Biodegradable in the soil. Low potential for adsorption in soil.
Biochemical oxygen demand (BOD)	2.15 g O ₂ /g substance
Chemical oxygen demand (COD)	2.52 g O ₂ /g substance
ThOD	3.13 g O ₂ /g substance
BOD (% of ThOD)	0.69 % ThOD

Toluene

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

12.3. Bioaccumulative potential

Toluene (108-88-3)	
BCF fish 1	13.2 (Anguilla japonica)
BCF fish 2	90 (72 h; Leuciscus idus)
BCF other aquatic organisms 1	380 (24 h; Chlorella sp.; Fresh weight)
BCF other aquatic organisms 2	4.2 (Mytilus edulis; Fresh weight)
Log Pow	2.73 (Experimental value; Other; 20 °C, Experimental value; Other; 20 °C, Experimental value; Other; 20 °C)
Bioaccumulative potential	Low potential for bioaccumulation (BCF < 500).

12.4. Mobility in soil

Toluene (108-88-3)	
Surface tension	0.03 N/m (20 °C)

12.5. Other adverse effects

No additional information available

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste disposal recommendations : Remove waste in accordance with local and/or national regulations. Hazardous waste shall not be mixed together with other waste. Different types of hazardous waste shall not be mixed together if this may entail a risk of pollution or create problems for the further management of the waste. Hazardous waste shall be managed responsibly. All entities that store, transport or handle hazardous waste shall take the necessary measures to prevent risks of pollution or damage to people or animals. Recycle by distillation. Do not landfill. Remove to an authorized waste incinerator for solvents with energy recovery. Do not discharge into drains or the environment. May be discharged to company wastewater treatment plant.

Additional information : LWCA (the Netherlands): KGA category 03. Hazardous waste according to Directive 2008/98/EC.

SECTION 14: Transport information

In accordance with DOT

Transport document description : UN1294 Toluene, 3, II
UN-No.(DOT) : 1294
DOT NA no. : UN1294
DOT Proper Shipping Name : Toluene
Department of Transportation (DOT) Hazard Classes : 3 - Class 3 - Flammable and combustible liquid 49 CFR 173.120
Hazard labels (DOT) : 3 - Flammable liquid



Packing group (DOT) : II - Medium Danger
DOT Special Provisions (49 CFR 172.102) : IB2 - Authorized IBCs: Metal (31A, 31B and 31N); Rigid plastics (31H1 and 31H2); Composite (31HZ1). Additional Requirement: Only liquids with a vapor pressure less than or equal to 110 kPa at 50 °C (1.1 bar at 122 °F), or 130 kPa at 55 °C (1.3 bar at 131 °F) are authorized.
T4 - 2.65 178.274(d)(2) Normal..... 178.275(d)(3)
TP1 - The maximum degree of filling must not exceed the degree of filling determined by the following: Degree of filling = $97 / (1 + a (tr - tf))$ Where: tr is the maximum mean bulk temperature during transport, and tf is the temperature in degrees celsius of the liquid during filling.
DOT Packaging Exceptions (49 CFR 173.xxx) : 150
DOT Packaging Non Bulk (49 CFR 173.xxx) : 202
DOT Packaging Bulk (49 CFR 173.xxx) : 242
DOT Quantity Limitations Passenger aircraft/rail (49 CFR 173.27) : 5 L
DOT Quantity Limitations Cargo aircraft only (49 CFR 175.75) : 60 L

Toluene

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

DOT Vessel Stowage Location : B - (i) The material may be stowed "on deck" or "under deck" on a cargo vessel and on a passenger vessel carrying a number of passengers limited to not more than the larger of 25 passengers, or one passenger per each 3 m of overall vessel length; and (ii) "On deck only" on passenger vessels in which the number of passengers specified in paragraph (k)(2)(i) of this section is exceeded.

Additional information

Other information : No supplementary information available.

State during transport (ADR-RID) : as liquid.

ADR

Transport document description : UN 1294 Toluene, 3, II, (D/E)

Packing group (ADR) : II

Class (ADR) : 3 - Flammable liquids

Hazard identification number (Kemler No.) : 33

Classification code (ADR) : F1

Danger labels (ADR) : 3 - Flammable liquids



Orange plates : An orange rectangular label with a black border, divided into two horizontal sections. The top section contains the number '33' and the bottom section contains the number '1294'.

Tunnel restriction code : D/E

Transport by sea

UN-No. (IMDG) : 1294

Class (IMDG) : 3 - Flammable liquids

EmS-No. (1) : F-E

EmS-No. (2) : S-D

Air transport

UN-No.(IATA) : 1294

Class (IATA) : 3 - Flammable Liquids

Packing group (IATA) : II - Medium Danger

SECTION 15: Regulatory information

15.1. US Federal regulations

Toluene (108-88-3)

Listed on the United States TSCA (Toxic Substances Control Act) inventory
Listed on SARA Section 313 (Specific toxic chemical listings)

RQ (Reportable quantity, section 304 of EPA's List of Lists) : 1000 lb

SARA Section 311/312 Hazard Classes : Immediate (acute) health hazard
Fire hazard

15.2. International regulations

CANADA

Toluene (108-88-3)

Listed on the Canadian DSL (Domestic Substances List) inventory.

WHMIS Classification : Class B Division 2 - Flammable Liquid
Class D Division 2 Subdivision B - Toxic material causing other toxic effects
Class D Division 2 Subdivision A - Very toxic material causing other toxic effects

Toluene

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

EU-Regulations

No additional information available

Classification according to Regulation (EC) No. 1272/2008 [CLP]

Flam. Liq. 2 H225
Repr. 2 H361d
Asp. Tox. 1 H304
STOT RE 2 H373
Skin Irrit. 2 H315
STOT SE 3 H336

Full text of H-phrases: see section 16

Classification according to Directive 67/548/EEC or 1999/45/EC

F; R11
Repr.Cat.3; R63
Xn; R65
Xn; R48/20
Xi; R38
R67

Full text of R-phrases: see section 16

15.2.2. National regulations

Toluene (108-88-3)

Listed on the Canadian Ingredient Disclosure List

15.3. US State regulations

Toluene(108-88-3)

U.S. - California - Proposition 65 - Developmental Toxicity	Yes
U.S. - California - Proposition 65 - Reproductive Toxicity - Female	Yes
No significance risk level (NSRL)	7000 µg/day

SECTION 16: Other information

Full text of H-phrases: see section 16:

Asp. Tox. 1	Aspiration hazard, Category 1
Flam. Liq. 2	Flammable liquids, Category 2
Repr. 2	Reproductive toxicity, Category 2
Skin Irrit. 2	Skin corrosion/irritation, Category 2
STOT RE 2	Specific target organ toxicity — Repeated exposure, Category 2
STOT SE 3	Specific target organ toxicity — Single exposure, Category 3, Narcosis
H225	Highly flammable liquid and vapour
H304	May be fatal if swallowed and enters airways
H315	Causes skin irritation
H336	May cause drowsiness or dizziness
H361	Suspected of damaging fertility or the unborn child
H373	May cause damage to organs through prolonged or repeated exposure

Toluene

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

NFPA health hazard

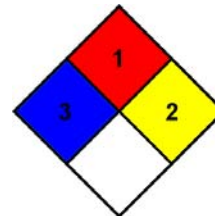
: 3 - Short exposure could cause serious temporary or residual injury even though prompt medical attention was given.

NFPA fire hazard

: 1 - Must be preheated before ignition can occur.

NFPA reactivity

: 2 - Normally unstable and readily undergo violent decomposition but do not detonate. Also: may react violently with water or may form potentially explosive mixtures with water.



HMIS III Rating

Health

: 3 Serious Hazard - Major injury likely unless prompt action is taken and medical treatment is given

Flammability

: 1 Slight Hazard

Physical

: 2 Moderate Hazard

Personal Protection

: H

SDS US (GHS HazCom 2012)


Information in this SDS is from available published sources and is believed to be accurate. No warranty, express or implied, is made and LabChem Inc assumes no liability resulting from the use of this SDS. The user must determine suitability of this information for his application.

Safety Data Sheets (SDS)

SECTION 1-IDENTIFICATION

Product name: Ethylbenzene
Other names: —
Proper shipping name: Ethylbenzene
Recommended use of the chemical and restrictions on use: The main use of ethylbenzene is to manufacture styrene, a compound used to make plastics. Ethylbenzene is also found in gasoline, paints, inks, insecticides, carpet glues and tobacco products.
Manufacturer/Supplier Name: Taiwan SM Corp., Kaohsiung plant Address: NO.7, Industrial 1st Rd, Lin-Yuan Kaohsiung County 83203, Taiwan, R.O.C. Phone No.: 886-7-6414511
Emergency phone No./Fax No.: 886-7-6414511 Ext. 221 (on duty), 886-7-6414517 (off duty)/886-7-6423828

SECTION 2-HAZARDS IDENTIFICATION

GHS Classification:	Flammable Liquid Category 2 Acute Toxicity (Inhalation) Category 4 Skin Corrosion/Irritation Category 3 Serious Eye Damage/Eye Irritation Category 2 Carcinogenicity Category 2 Reproductive Toxicity Category 2 Specific Target Organ Toxicity Repeated Exposure Category 2 Aspiration Hazard Category 1
GHS Label elements:	
Hazard symbols	
Signal word	Danger
Hazard statements	Flammable liquid and vapor Harmful if inhaled Causes skin irritation Causes serious eye irritation Suspected of causing cancer May damage the unborn child May be harmful to organs by prolonged and repeated exposure May be fatal if swallowed and enters airways
Precautionary statements	Use only in well ventilated area. Control of exposure by mechanical ventilation in an unventilated or confined space Avoid breathing vapors and contact with skin and eyes. Wear breathing apparatus/protective gloves/face protection. Store in well-ventilated place. Disposal must be in accordance with applicable federal, state, or local regulations.
Other hazards: —	

SECTION 3-COMPOSITION/INFORMATION ON INGREDIENTS

CAS No.	Chemical Name	wt% by weight	EINECS No.
00100-41-4	Ethylbenzene	99.0 min.	202-849-4
Synonyms	Phenylethane 、 EB 、 Ethylbenzol		

SECTION 4-FIRST AID MEASURES

Description of necessary first aid measures

Eye:

1. Flush eye with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids.
2. Get medical aid immediately.

Skin:

1. Washing affected area thoroughly with soap and water for at least 20 minutes.
2. Call a Physician if irritation develops or persists.
3. Removing contaminated clothing, shoes, and leathery wearings, cleaning procedure is available before reused or waste treatment.

Ingestion:

1. If victim is conscious and alert, give 2~4 cupfuls of milk/water to dilute the substance in stomach.
2. Never give anything by mouth to an unconscious person.
3. Don't induce vomiting unless directed to do so by medical person.
4. Then seek for medical attention.

Inhalation:

1. Remove from further exposure and flush thoroughly with air.
2. If not breathing, give artificial respiration. If breathing is difficult, give Oxygen.
3. If respiratory irritation, seek immediate medical assistance and call a physician.

Most important symptoms/effects, acute and delayed

Headaches, dizziness, fatigue, eye, nose and throat irritation. Target organs: Eyes, upper respiratory system, skin, CNS, lung, liver, kidney, skin (dermatitis), eye (conjunctivitis and other eye injuries), upper respiratory system disorders, and central nervous system disorders.

Indication of immediate medical attention and special treatment needed, if necessary

For acute or short term repeated exposures to Ethylbenzene:

Inhalation:

1. Severe exposures should have cardiac monitoring to detect arrhythmia.
2. If bronchospasm and wheezing occur, consider treatment with inhaled sympathomimetic agents.
3. If pulmonary edema (noncardiogenic) occurs, then maintain ventilation and oxygenation with close arterial blood gas monitoring. Early use of PEEP and mechanical ventilation may be needed to maintain pO₂ greater than 50 mmHG with FIO₂ less than 60%.

Ingestion:

1. Induction of emesis is not recommended.
2. Cautious gastric lavage followed by administration of activated charcoal may be of benefit if the patient is seen soon after the exposure.

SECTION 5-FIRE FIGHTING MEASURES

Extinguishing media

Foam · CO₂ · Dry chemical powder · Water spray or fog – Large fires only.

Specific hazards arising from the chemical

1. Liquid and vapor are flammable.
2. Moderate fire hazard when exposed to heat or flame.
3. Vapor forms an explosive mixture with air.
4. Moderate explosion hazard when exposed to heat or flame.
5. Vapor may travel a considerable distance to source of ignition.
6. Heating may cause expansion or decomposition leading to violent rupture of containers.
7. On combustion, may emit toxic fumes of carbon monoxide (CO).

Special protective equipment and precautions for fire-fighters

1. Must wear MSHA/NOISH approved positive self-contained breathing apparatus (SCBA) and protective clothing.
2. Withdrawing and isolation the possible dangerous sources, fire fighting at safe distance and suitable protection area. Keep toxic vapors and decompositions away from inhalation, when standing at upper-wind area as well.
3. Stop leakage before fire extinguishing, otherwise it may explode again because of vapors above leakage. However, it's not well extinguishment at nondangerous circumstance, preferring to burning up.
4. Water spray may not work effectively in terms of lower flash point. Better fire fighting performed by experienced people.
5. In huge fire at larger area, automatic water spray system should be recommended. If extinguishing is not available, evacuating people back as soon as possible.
6. Out off the space immediately, if vessel collapsed or pressure relief valve went pop.

SECTION 6-ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedure

1. Personal protective equipment (specified in Section 8)
Eyes : Chemical safety goggles are recommended, and a face shield is added when needed.
Skin : Wear appropriate protective gloves to avoid skin contact.
Clothing : When direct contact is likely, Use rubberized clothings, apron and boots.
Respiratory : When limits are exceeded, wear a respirator approved by NIOSH/MSHA for protection against organic dust, mists and vapors.
2. Remove all sources of ignition. No smoking, naked lights or ignition sources. Ventilate area of leak or spill.
3. Keep unnecessary and unprotected personnel from entering. Evacuate personnel from the danger area. Consult with an expert about the emergency procedures.

Environmental precautions

1. Prevent spillage from entering drains, surface, and groundwater.
2. Contain and recover liquid when possible. Use non-sparking tools and equipment.
3. Collect liquid in an appropriate container or absorb with an inert material (e.g. vermiculite, dry sand, earth), and place in a chemical waste container.
4. Report the accidental spill/release to Local/State government.

Methods and materials for containment and cleaning up

Minor spill:

1. Remove all ignition sources.
2. Clean up all spills immediately.
3. Avoid breathing vapors and contact with skin and eyes.
4. Control personal contact by using protective equipment.
5. Contain and absorb small quantities with vermiculite or other absorbent material.
6. Wipe up.
7. Collect residues in a flammable waste container.

Major spill

1. Clear area of personnel and move upwind.
2. Alert emergency responders and tell them location and nature of hazard.
3. May be violently or explosively reactive.
4. Wear breathing apparatus plus protective gloves.
5. Prevent spillage from entering drains or water course.
6. No smoking, naked lights or ignition sources. Increase ventilation.
7. Stop leak if safe to do so.
8. Water spray or fog may be used to disperse/absorb vapor.
9. Contain spill with sand, earth or vermiculite.
10. Use only spark-free shovels and explosion proof equipment.
11. Collect recoverable product into labeled containers for recycling..
12. Absorb remaining product with sand, earth or vermiculite.
13. Collect solid residues and seal in labeled drums for disposal.
14. Wash area and prevent runoff into drains.
15. If contamination of drains or waterways occurs, advise emergency services.

SECTION 7-HANDLING AND STORAGE

Precautions for safe handling

1. Wash thoroughly after handling.
2. Use only in well ventilated area.
3. Ground and bond containers when transferring.
4. Use spark-free tools and explosion proof equipment.
5. Empty containers retain product residue (liquid/vapor), and can be dangerous.
6. Do not pressurize, cut, weld, braze, solder, drill, or expose empty containers to heat, sparks or open flames.

Conditions for safe storage, including any incompatibilities

1. Iron, galvanized iron, and steel are suitable metals for tanks.
2. Storage should be located away from any area subject to fire hazards. Storage tanks located in the open or underground minimize the danger of fire, vapor and health problems.
3. All openings in the system should terminate outdoors and be protected by flash screen.
4. Electrical installation should conform to the National Electrical Code.
5. Storage tanks should be electrically bonded and grounded to prevent dangerous accumulations of static electricity. (see NFPA pamphlet "Static Electricity")
6. Natural ventilation is all that is needed for outdoor storage installation.
7. For indoor storage : Good natural ventilation may be sufficient. The generally considered maximum allowable concentration is 100 ppm by volume in air for an eight-hour working exposure. If other than natural ventilation is required,

the ventilation equipment should be designed to handle the heavy ethylbenzene vapor. Since ethylbenzene vapor is heavier than air, a down draft mechanical exhaust is indicated in those operation in which general ventilation should be to ensure a substantial air flow away from the work area. All ventilating systems require periodic inspection.

SECTION 8-EXPOSURE CONTROLS, PERSONAL PROTECTION

Control parameters

OSHA- Final PELs : 100 ppm TWA.

ACGIH TLV-TEL : 100 ppm.

ACGIH TLV-STEL : 125 ppm.

Taiwan TWA : 100 ppm (skin).

Taiwan STEL : 125 ppm (skin).

Taiwan Ceiling : -----.

Taiwan BEI : 1 mg/l (before on duty).

Engineering control

1. Process should be located at least 17 meter (50 feet) away from open flames and all high temperature operations likely to cause ignition of the ethylbenzene vapor.
2. In venting ethylbenzene vapors, consideration should be given to possible halogenation of the vapors by low concentrations of free chlorine and bromine with the resultant formation of lacrimations.
3. Process should be designed so that the operator is not exposed to direct contact with ethylbenzene or the vapor. The technical problems of designing equipment, providing adequate ventilation and operating procedures which promise maximum security and economy, can best be handled by competent engineers.
4. It is essential for safety that equipment be used and maintained as recommended by the manufacturer.
5. Tanks used to store or process ethylbenzene should be closed vessels vented to a safe point of discharge in the outside atmosphere away from operating stations, roadways, and at least 17 meter (50 feet) from possible sources of ignitions. All sparks, flames, heated surface, or other sources of ignition should be kept away from all vents. It is advisable, to provide suction on vessels when inspection or observation openings are made, to minimize or eliminate escape of vapors.

Personal protective equipment

Personal respirators (NIOSH Approved):

If the exposure limit is exceeded, a half-face organic vapor respirator may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece organic vapor respirator may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-face piece positive-pressure, air-supplied respirator.

(Warning: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.)

Skin protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

SECTION 9-PHYSICAL AND CHEMICAL PROPERTIES

Appearance : Transparent liquid	Upper/lower explosive limits : 1.0% ~ 6.7%
Odor: Aromatic odor	Vapor Pressure : 7.1 mmHg @ 20°C / 68°F
Odor threshold : 0.092 ~ 0.6 ppm	Vapor Density : 3.66 (air=1)
PH : Not available	Relative density : 0.864 (water=1)
Melting/Freezing Point : -94.9°C	Solubility : 0.015 @ 25°C in water
Initial boiling point/boiling range : 132.6°C	Partition coefficient : 3.15 (n-octanol/water)
Flash point : 21°C	Auto-ignition temperature : 432°C
Evaporation Rate : 0.84 (BuAc=1)	Decomposition temperature : Not available
Flammability (solid/gas) : Not available	Viscosity : Not available
Molecular Formula : C ₈ H ₁₀	Molecular Weight : 106.7

SECTION 10-STABILITY AND REACTIVITY

Reactivity

The product is stable. Vapor is explosive when exposed to heat or flame.

Chemical stability

Stable under normal temperatures and pressures.

Possibility of hazardous reaction

Has not been reported.

Condition to avoid Incompatible materials, ignition sources, excess heat.
Incompatible materials Oxidizing agents.
Hazardous decomposition products Carbon dioxide and carbon monoxide may form when heated to decomposition.

SECTION 11-TOXICOLOGICAL INFORMATION

Routes of exposure Eye, Skin, inhalation, Ingestion.
Symptoms (treatments as indicated in Section 4) <p>Eye: May cause irritation, redness, pain, and corneal damage.</p> <p>Skin: Causes irritation to skin. Symptoms include redness, itching, and pain. May produce blisters. May be absorbed through the skin.</p> <p>Ingestion: May cause irritation to the gastrointestinal tract. Symptoms may include nausea, vomiting and diarrhea. May cause central nervous system depression. Symptoms may include giddiness, headache, dizziness, nausea, anaesthetic effects, slowed reaction time, slurred speech and may progress to unconsciousness. Serious poisonings may result in respiratory depression and may be fatal.</p> <p>Inhalation: Inhalation of high concentrations of gas/vapor causes lung irritation with coughing and nausea, central nervous depression with headache and dizziness, slowing of reflexes, fatigue and inco-ordination. Central nervous system (CNS) depression may include general discomfort, symptoms of giddiness, headache, dizziness, nausea, anaesthetic effects, slowed reaction time, slurred speech and may progress to unconsciousness. Serious poisonings may result in respiratory depression and may be fatal. If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death.</p> <p>Chronic exposure: There has been some concern that this material can cause cancer or mutations but there is not enough data to make an assessment. Limited evidence suggests that repeated or long-term occupational exposure may produce cumulative health effects involving organs or biochemical systems. Chronic solvent inhalation exposures may result in nervous system impairment and liver and blood changes.</p> <p>Aggravation of pre-existing conditions: Persons with pre-existing skin disorders, eye problems, liver disease, central nervous system disorders, or impaired respiratory function may be more susceptible to the effects of the substance.</p>
Toxicity LD50: 3500 mg/kg (rat, oral) LC50: 4000 ppm/4h (rat, inhalation)
Irritation Skin (rabbit): 15 mg/24h Mild Eye (rabbit): 500 mg- SEVERE
Chronic effect Carcinogenicity: ACGIH : A3- Proven for animals. OSHA : Classified None. IARC : Group 2B carcinogen.
Epidemiology: Not available.
Teratogenicity: Not available.
Reproductive Effects: Not available.

Neurotoxicity: Not available
Mutagenicity: Mutation in mammalian somatic cells (Rodent, mouse) Lymphocyte=80mg/L.



SECTION 12-ECOLOGICAL INFORMATION



Ecotoxicity LC ₅₀ (96 hr.) Fish: 32.0~97.1 mg/l EC ₅₀ (48 hr.) Water flea: Not available Biocencentration factor (BCF): Not available
Persistence and degradability 1. In the atmosphere, it exists primarily in the vapor phase based on its vapor pressure. It photochemically degrades by reaction with hydroxyl radicals (half-life 0.5 to 2 days) and partially returns to the earth in rain. 2. Degradation occurs faster under smog conditions. Photooxidation products include ethylphenol, benzaldehyde, acetophenone and m- and p- ethylnitrobenzene. 3. In water, ethylbenzene's concentration decreases by evaporation and biodegradation. The rate of decrease is dependent on the season. Half-lives in water range from several days to 2 weeks. 4. Some ethylbenzene is absorbed by sediment, but bioconcentration in fish is not expected to be significant. Half-life (Air): 8.56~85.6 hr Half-life (Surface water): 72~240 hr Half-life (Ground water): 144~5472 hr Half-life (Soil): 7.2~240 hr
Bioaccumulative potential This material is not expected to significantly bioaccumulate.
Mobility in soil Ethylbenzene is adsorbed moderately by soil. It does not significantly hydrolyze in either water or soil.
Other adverse effects: —

SECTION 13-DISPOSAL CONSIDERATIONS

Residues and spilled material are hazardous waste due to ignitability. Disposal must be in accordance with applicable federal, state, or local regulations.
The container for this product can present explosion or fire hazards, even when emptied. To avoid risk of injury, do not cut, puncture, or weld on or near this container. Since the emptied containers retain product residue, follow label warnings even after container is emptied.

SECTION 14-TRANSPORTATION INFORMATION

US DOT	Shipping Name	ETHYLBENZENE	Hazard Labels	
	Hazard Class	3		
	UN Number	1175		
	Packing Group	II		
Sea(IMO/IMDG)	Shipping Name	ETHYLBENZENE	Hazard Labels	
	Hazard Class	3.2		
	UN Number	1175		
	Packing Group	II		
Air(ICA0/IATA)	Shipping Name	ETHYLBENZENE	Hazard Labels	
	Hazard Class	3		
	Subsidiary Class	1175		
	Packing Group	II		

EUROPEAN RID/ADR (ADR/RID)	Shipping Name	ETHYLBENZENE	Hazard Labels	
	Hazard Class	3		
	UN Number	1175		
Canadian TDG	Shipping Name	ETHYLBENZENE	Hazard Labels	
	Hazard Class	3		
	UN Number	1175		
	Packing Group	II		
	Subsidiary Class	9.2		

SECTION 15-REGULATORY INFORMATION

US FEDERAL	
TSCA	<p>CAS# 100-41-4 is listed on the TSCA inventory. Health & Safety Reporting List CAS# 100-41-4 : Effective Date : June 19, 1987 ; Sunset Date : June 19, 1997 Chemical Test Rules None of the chemicals in this product are under a Chemical Test Rule. Section 12b None of the chemicals are listed under TSCA section 12b. TSCA Significant New Use Rule None of the chemicals in this material have a SNUR under TSCA.</p>
SARA	<p>Section 302 (RQ) CAS# 100-41-4 : final RQ = 1000 pounds (454 kg) Section 302 (TPQ) None of the chemicals in this product have a TPQ. SARA Codes CAS# 100-41-4 : acute, chronic, flammable. Section 313 This material contains Ethylbenzene (CAS# 100-41-4, 99.0%) ,which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 372.</p>
Clean Air Act	<p>CAS# 100-41-4 is listed as a hazardous air pollutant (HAP) . This material does not contain any class 1 Ozone depleters. This material does not contain any class 2 Ozone depleters.</p>
Clean Water Act	<p>CAS# 100-41-4 is listed as a hazardous Substance under the CWA. CAS# 100-41-4 is listed as a Priority Pollutant under the Clean Water Act. CAS# 100-41-4 is listed as a Toxic Pollutant under the Clean Water Act.</p>
OSHA	<p>None of the chemicals in this product are considered highly hazardous by OSHA.</p>
STATE	
Ethylbenzene can be found on the following state right to know lists : California, New Jersey, Florida, Pennsylvania, Minnesota, Massachusetts.	
California No Significant Risk Level : None of the chemicals in this product are listed.	
European/International Regulations	
European Labeling in Accordance with EC Directives	<p>Hazard Symbols : XN F Risk Phrases : R 11 Highly flammable. R 20 Harmful by inhalation. Safety Phrases : S 16 Keep away from sources of ignition-No smoking. S 24/25 Avoid contact with skin and eyes. S 29 Do not empty into drains.</p>
CANADA	<p>CAS# 100-41-4 is listed on Canada's DSL/NDSL list. This product has a WHMIS classification of B2, D2B.</p>

SECTION 16-OTHER INFORMATION**References and sources**

1. CHEMINFO Data Bank, CCINFO CD, 2005-3
2. HSDB Data Bank, TOMES PLUS CD, Vol.65,2005
3. RETECS Data Bank, TOMES PLUS CD, Vol.65, 2000
4. Hazardous Substance Data Bank, Environment Protection, Administration, Executive Yuan, ROC (Taiwan)
5. Chemwatch Data Bank, 2005-1
6. SDS, GHS in Taiwan, Council of Labor Affairs, Executive Yuan, ROC (Taiwan)

Version	Date	Remark
Version 1	06/01/1998	Original Version.
Version 2	04/20/2001	Updated 10 sections to 16 sections.
Version 3	08/01/2003	Updated "SECTION 9-PHYSICAL AND CHEMICAL PROPERTIES".
Version 4	01/01/2006	Updated "SECTION 14-TRANSPORTATION INFORMATION".
Version 5	08/21/2008	Updated each section by GHS SDS.
Version 6	08/01/2011	Checked each section by SHE
Prepared by	Safety & Environment Protection Section, Taiwan SM Corporation Kaohsiung Plant.	

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Product form	: Substance
Substance name	: Xylenes
CAS No	: 1330-20-7
Product code	: VT910
Formula	: C ₈ H ₁₀
Synonyms	: benzene, dimethyl- / dimethylbenzene, mixture of isomers / dimethylbenzol, mixture of isomers / methyltoluene, mixture of isomers / mixed xylenes / xylol
Other means of identification	: Xylenes, mixture of ortho, meta and para isomers with ethylbenzene

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/mixture	: Solvent Cleaning product Chemical raw material
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1.3. Details of the supplier of the safety data sheet

Val Tech Diagnostics, A Division of LabChem Inc
Jackson's Pointe Commerce Park Building 1000
1010 Jackson's Pointe Court
Zelienople, PA 16063
T 412-826-5230
F 724-473-0647

1.4. Emergency telephone number

Emergency number	: CHEMTREC: 1-800-424-9300 or 011-703-527-3887
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SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Classification (GHS-US)

Flam. Liq. 3 H226
Skin Irrit. 2 H315
Aquatic Acute 2 H401

Full text of H-phrases: see section 16

2.2. Label elements

GHS-US labeling

Hazard pictograms (GHS-US)



Signal word (GHS-US)

: Warning

Hazard statements (GHS-US)

: H226 - Flammable liquid and vapor
H315 - Causes skin irritation
H401 - Toxic to aquatic life

Precautionary statements (GHS-US)

: P210 - Keep away from heat, hot surfaces, open flames, sparks. - No smoking
P233 - Keep container tightly closed
P240 - Ground/bond container and receiving equipment
P241 - Use explosion-proof electrical, lighting, ventilating equipment
P242 - Use only non-sparking tools
P243 - Take precautionary measures against static discharge
P264 - Wash exposed skin thoroughly after handling
P273 - Avoid release to the environment
P280 - Wear eye protection, face protection, protective clothing, protective gloves
P303+P361+P353 - IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower
P332+P313 - If skin irritation occurs: Get medical advice/attention

Xylenes

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

P363 - Wash contaminated clothing before reuse
P370+P378 - In case of fire: Use carbon dioxide (CO₂), powder, alcohol-resistant foam to extinguish
P403+P235 - Store in a well-ventilated place. Keep cool
P501 - Dispose of contents/container to comply with local, state and federal regulations

2.3. Other hazards

Other hazards not contributing to the classification : None.

2.4. Unknown acute toxicity (GHS-US)

No data available

SECTION 3: Composition/information on ingredients

3.1. Substance

Substance type : Multi-constituent
Name : Xylenes
CAS No : 1330-20-7
EC no : 215-535-7
EC index no : 601-022-00-9

Name	Product identifier	%	Classification (GHS-US)
Xylenes (Main constituent)	(CAS No) 1330-20-7	100	Flam. Liq. 3, H226 Skin Irrit. 2, H315 Aquatic Acute 2, H401

Full text of H-phrases: see section 16

3.2. Mixture

Not applicable

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures general : Check the vital functions. Unconscious: maintain adequate airway and respiration. Respiratory arrest: artificial respiration or oxygen. Cardiac arrest: perform resuscitation. Victim conscious with labored breathing: half-seated. Victim in shock: on his back with legs slightly raised. Vomiting: prevent asphyxia/aspiration pneumonia. Prevent cooling by covering the victim (no warming up). Keep watching the victim. Give psychological aid. Keep the victim calm, avoid physical strain. Depending on the victim's condition: doctor/hospital. Never give alcohol to drink.

First-aid measures after inhalation : Remove the victim into fresh air. Respiratory problems: consult a doctor/medical service.

First-aid measures after skin contact : Wash immediately with lots of water. Soap may be used. Do not apply (chemical) neutralizing agents. Take victim to a doctor if irritation persists.

First-aid measures after eye contact : Rinse immediately with plenty of water. Do not apply neutralizing agents. Take victim to an ophthalmologist if irritation persists.

First-aid measures after ingestion : Rinse mouth with water. Do not induce vomiting. Call Poison Information Centre (www.big.be/antigif.htm). Consult a doctor/medical service if you feel unwell. Ingestion of large quantities: immediately to hospital.

4.2. Most important symptoms and effects, both acute and delayed

Symptoms/injuries after inhalation : EXPOSURE TO HIGH CONCENTRATIONS: Irritation of the respiratory tract. Irritation of the nasal mucous membranes. Central nervous system depression. Dizziness. Headache. Coordination disorders. Disturbed motor response. Impaired memory. Disturbances of consciousness.

Symptoms/injuries after skin contact : Tingling/irritation of the skin.

Symptoms/injuries after eye contact : Irritation of the eye tissue.

Symptoms/injuries after ingestion : AFTER ABSORPTION OF LARGE QUANTITIES: Enlargement/disease of the liver. Symptoms similar to those listed under inhalation.

Chronic symptoms : ON CONTINUOUS/REPEATED EXPOSURE/CONTACT: Dry skin. Itching.

4.3. Indication of any immediate medical attention and special treatment needed

No additional information available

Xylenes

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

SECTION 5: Firefighting measures

5.1. Extinguishing media

- Suitable extinguishing media : Water spray. Polyvalent foam. Alcohol-resistant foam. BC powder. Carbon dioxide.
- Unsuitable extinguishing media : Solid water jet ineffective as extinguishing medium.

5.2. Special hazards arising from the substance or mixture

- Fire hazard : DIRECT FIRE HAZARD. Flammable. Gas/vapor flammable with air within explosion limits. INDIRECT FIRE HAZARD. May build up electrostatic charges: risk of ignition. May be ignited by sparks. Gas/vapor spreads at floor level: ignition hazard. Reactions involving a fire hazard: see "Reactivity Hazard".
- Explosion hazard : DIRECT EXPLOSION HAZARD. Gas/vapour explosive with air within explosion limits. INDIRECT EXPLOSION HAZARD. may be ignited by sparks. Reactions with explosion hazards: see "Reactivity Hazard".
- Reactivity : Upon combustion: CO and CO₂ are formed. Reacts violently with (strong) oxidizers: (increased) risk of fire/explosion. Reacts with (some) acids.

5.3. Advice for firefighters

- Precautionary measures fire : Exposure to fire/heat: keep upwind. Exposure to fire/heat: consider evacuation. Exposure to fire/heat: seal off low-lying areas. Exposure to fire/heat: have neighbourhood close doors and windows.
- Firefighting instructions : Cool tanks/drums with water spray/remove them into safety.
- Protection during firefighting : Heat/fire exposure: compressed air/oxygen apparatus.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

6.1.1. For non-emergency personnel

- Protective equipment : Gloves. Face-shield. Protective clothing. Large spills/in enclosed spaces: compressed air apparatus. See "Material-Handling" to select protective clothing.
- Emergency procedures : Mark the danger area. Stop engines and no smoking. No naked flames or sparks. Spark- and explosion-proof appliances and lighting equipment. Wash contaminated clothes. Large spills/in confined spaces: consider evacuation. In case of reactivity hazard: consider evacuation.

6.1.2. For emergency responders

- Protective equipment : Equip cleanup crew with proper protection. Do not breathe gas, fumes, vapor or spray.
- Emergency procedures : If a major spill occurs, all personnel should be immediately evacuated and the area ventilated. Stop release. Ventilate area.

6.2. Environmental precautions

- Prevent spreading in sewers.

6.3. Methods and material for containment and cleaning up

- For containment : Contain released substance, pump into suitable containers. Plug the leak, cut off the supply. Dam up the liquid spill. Provide equipment/receptacles with earthing. Do not use compressed air for pumping over spills. Heating: dilute combustible gas/vapour with water curtain.
- Methods for cleaning up : Take up liquid spill into a non combustible material e.g.: sand, earth, vermiculite or powdered limestone. Scoop absorbed substance into closing containers. Carefully collect the spill/leftovers. Spill must not return in its original container. Damaged/cooled tanks must be emptied. Do not use compressed air for pumping over spills. Clean contaminated surfaces with an excess of water. Take collected spill to manufacturer/competent authority. Wash clothing and equipment after handling.

6.4. Reference to other sections

- No additional information available

SECTION 7: Handling and storage

7.1. Precautions for safe handling

- Precautions for safe handling : Comply with the legal requirements. Remove contaminated clothing immediately. Clean contaminated clothing. Thoroughly clean/dry the installation before use. Do not discharge the waste into the drain. Do not use compressed air for pumping over. Use spark-/explosionproof appliances and lighting system. Take precautions against electrostatic charges. Keep away from naked flames/heat. Keep away from ignition sources/sparks. Observe normal hygiene standards. Keep container tightly closed. Measure the concentration in the air regularly. Carry operations in the open/under local exhaust/ventilation or with respiratory protection.

Xylenes

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

Hygiene measures : Wash contaminated clothing before reuse. Do not eat, drink or smoke when using this product.
Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work.

7.2. Conditions for safe storage, including any incompatibilities

Incompatible products : Strong oxidizers.
Heat-ignition : KEEP SUBSTANCE AWAY FROM: heat sources. ignition sources.
Prohibitions on mixed storage : KEEP SUBSTANCE AWAY FROM: combustible materials. oxidizing agents. strong acids. halogens. highly flammable materials.
Storage area : Store in a cool area. Ventilation at floor level. Fireproof storeroom. Provide for a tub to collect spills. Provide the tank with earthing. Meet the legal requirements.
Special rules on packaging : SPECIAL REQUIREMENTS: closing. clean. correctly labelled. meet the legal requirements. Secure fragile packagings in solid containers.
Packaging materials : SUITABLE MATERIAL: No data available. MATERIAL TO AVOID: No data available.

7.3. Specific end use(s)

No additional information available

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Xylenes (1330-20-7)		
USA ACGIH	ACGIH TWA (ppm)	100 ppm
USA OSHA	OSHA PEL (TWA) (mg/m ³)	435 mg/m ³
USA OSHA	OSHA PEL (TWA) (ppm)	100 ppm

8.2. Exposure controls

Appropriate engineering controls : Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure. Provide adequate general and local exhaust ventilation.
Materials for protective clothing : GIVE EXCELLENT RESISTANCE: No data available. GIVE GOOD RESISTANCE: PVA. viton. tetrafluoroethylene. GIVE LESS RESISTANCE: No data available. GIVE POOR RESISTANCE: butyl rubber. natural rubber. neoprene. polyethylene. nitrile rubber.
Hand protection : Gloves.
Eye protection : Face shield.
Skin and body protection : Protective clothing.
Respiratory protection : Wear gas mask with filter type A if conc. in air > exposure limit.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state : Liquid
Appearance : Liquid.
Molecular mass : 106.17 g/mol
Color : Colourless to light yellow.
Odor : Pleasant odour. Aromatic odour.
Odor threshold : No data available
pH : No data available
Relative evaporation rate (butyl acetate=1) : No data available
Relative evaporation rate (ether=1) : 9.2 - 13.5
Melting point : No data available
Freezing point : No data available
Boiling point : 135 - 145 °C
Flash point : 25 °C
Critical temperature : 346 - 359 °C
Auto-ignition temperature : 464 °C
Decomposition temperature : No data available
Flammability (solid, gas) : No data available
Vapor pressure : 6.7 - 8.7 hPa
Vapor pressure at 50 °C : 32 - 43 hPa

Xylenes

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

Critical pressure	: 35160 - 37100 hPa
Relative vapor density at 20 °C	: 3.7
Relative density	: 0.86 - 0.88
Relative density of saturated gas/air mixture	: 1.02
Specific gravity / density	: 861 - 880 kg/m ³
Solubility	: Insoluble in water. Soluble in ethanol. Soluble in ether. Soluble in acetone. Soluble in petroleum spirit. Water: < 0.02 g/100ml Ethanol: Complete Ether: Complete
Log Pow	: 3.2 (Conclusion by analogy; 20 °C)
Log Kow	: No data available
Viscosity, kinematic	: No data available
Viscosity, dynamic	: No data available
Explosive properties	: No data available
Oxidizing properties	: No data available
Explosive limits	: 1.0 - 7.0 vol % 44 - 310 g/m ³

9.2. Other information

Minimum ignition energy	: 0.2 mJ
Specific conductivity	: 0.1 pS/m
Saturation concentration	: (20°C) 29/37
VOC content	: 100 %
Other properties	: Gas/vapour heavier than air at 20°C. Clear. Physical properties depending on the composition. Slightly volatile. May generate electrostatic charges.

SECTION 10: Stability and reactivity

10.1. Reactivity

Upon combustion: CO and CO₂ are formed. Reacts violently with (strong) oxidizers: (increased) risk of fire/explosion. Reacts with (some) acids.

10.2. Chemical stability

Stable under normal conditions.

10.3. Possibility of hazardous reactions

No additional information available

10.4. Conditions to avoid

High temperature. Incompatible materials. Open flame. Sparks.

10.5. Incompatible materials

Strong oxidizers. Strong acids.

10.6. Hazardous decomposition products

Carbon dioxide. Carbon monoxide.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity : Not classified

Xylenes (f)1330-20-7	
LD50 oral rat	3523 - 8600 mg/kg (Rat; OECD 401: Acute Oral Toxicity; Literature study; 3523 mg/kg bodyweight; Rat; OECD 401: Acute Oral Toxicity; Experimental value; >4000 mg/kg bodyweight; Rat; OECD 401: Acute Oral Toxicity; Experimental value)
LD50 dermal rabbit	> 4200 mg/kg body weight (Rabbit; Experimental value; OECD 402: Acute Dermal Toxicity)
LC50 inhalation rat (mg/l)	29 mg/l/4h (Rat; Experimental value; 27.57 mg/l/4h; Rat; Experimental value)

Skin corrosion/irritation	: Causes skin irritation.
Serious eye damage/irritation	: Not classified
Respiratory or skin sensitization	: Not classified
Germ cell mutagenicity	: Not classified

Xylenes

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

Carcinogenicity : Not classified

Xylenes (1330-20-7)

IARC group	3 - Not classifiable
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Reproductive toxicity : Not classified

Specific target organ toxicity (single exposure) : Not classified

Specific target organ toxicity (repeated exposure) : Not classified

Aspiration hazard : Not classified

Symptoms/injuries after inhalation : EXPOSURE TO HIGH CONCENTRATIONS: Irritation of the respiratory tract. Irritation of the nasal mucous membranes. Central nervous system depression. Dizziness. Headache. Coordination disorders. Disturbed motor response. Impaired memory. Disturbances of consciousness.

Symptoms/injuries after skin contact : Tingling/irritation of the skin.

Symptoms/injuries after eye contact : Irritation of the eye tissue.

Symptoms/injuries after ingestion : AFTER ABSORPTION OF LARGE QUANTITIES: Enlargement/disease of the liver. Symptoms similar to those listed under inhalation.

Chronic symptoms : ON CONTINUOUS/REPEATED EXPOSURE/CONTACT: Dry skin. Itching.

SECTION 12: Ecological information

12.1. Toxicity

Ecology - general : Not classified as dangerous for the environment according to the criteria of Regulation (EC) No 1272/2008. Not classified as dangerous for the environment according to the criteria of Directive 67/548/EEC.

Ecology - air : Not classified as dangerous for the ozone layer (Regulation (EC) No 1005/2009). Not included in the list of substances which may contribute to the greenhouse effect (Regulation (EC) No 842/2006). TA-Luft Klasse 5.2.5/I.

Ecology - water : Fouling to shoreline. Ground water pollutant. Toxic to fishes. Toxic to invertebrates (Daphnia). Toxic to algae. Not harmful to activated sludge.

Xylenes (1330-20-7)

LC50 fish 1	13.5 mg/l (96 h; <i>Lepomis macrochirus</i> ; Lethal)
EC50 Daphnia 1	150 mg/l (24 h; <i>Daphnia magna</i>)
LC50 fish 2	3.77 mg/l 96 h; <i>Salmo gairdneri</i> (<i>Oncorhynchus mykiss</i>)
EC50 Daphnia 2	7.4 mg/l (48 h; <i>Daphnia magna</i>)
Threshold limit algae 1	72 mg/l (336 h; <i>Selenastrum capricornutum</i> ; Growth)
Threshold limit algae 2	10 mg/l (72 h; <i>Skeletonema costatum</i>)

12.2. Persistence and degradability

Xylenes (1330-20-7)

Persistence and degradability	Readily biodegradable in water. Biodegradable in the soil. No test data on mobility of the substance available. Photolysis in the air.
-------------------------------	--

12.3. Bioaccumulative potential

Xylenes (1330-20-7)

BCF fish 1	15 8 weeks; <i>Salmo gairdneri</i> (<i>Oncorhynchus mykiss</i>)
BCF fish 2	7 - 26 (8 weeks; <i>Oncorhynchus mykiss</i>)
Log Pow	3.2 (Conclusion by analogy; 20 °C)
Bioaccumulative potential	Low potential for bioaccumulation (BCF < 500).

12.4. Mobility in soil

Xylenes (1330-20-7)

Ecology - soil	May be harmful to plant growth, blooming and fruit formation.
----------------	---

12.5. Other adverse effects

No additional information available

Xylenes

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

SECTION 13: Disposal considerations

13.1. Waste treatment methods

- Waste disposal recommendations : Remove waste in accordance with local and/or national regulations. Hazardous waste shall not be mixed together with other waste. Different types of hazardous waste shall not be mixed together if this may entail a risk of pollution or create problems for the further management of the waste. Hazardous waste shall be managed responsibly. All entities that store, transport or handle hazardous waste shall take the necessary measures to prevent risks of pollution or damage to people or animals. Recycle by distillation. Incinerate under surveillance with energy recovery. Do not discharge into surface water.
- Additional information : LWCA (the Netherlands): KGA category 03. Hazardous waste according to Directive 2008/98/EC.

SECTION 14: Transport information

In accordance with DOT

- Transport document description : UN1307 Xylenes, 3, III
- UN-No.(DOT) : 1307
- DOT NA no. : UN1307
- Proper Shipping Name (DOT) : Xylenes
- Department of Transportation (DOT) Hazard Classes : 3 - Class 3 - Flammable and combustible liquid 49 CFR 173.120
- Hazard labels (DOT) : 3 - Flammable liquid



- Packing group (DOT) : III - Minor Danger
- DOT Special Provisions (49 CFR 172.102) : B1 - If the material has a flash point at or above 38 C (100 F) and below 93 C (200 F), then the bulk packaging requirements of 173.241 of this subchapter are applicable. If the material has a flash point of less than 38 C (100 F), then the bulk packaging requirements of 173.242 of this subchapter are applicable.
IB3 - Authorized IBCs: Metal (31A, 31B and 31N); Rigid plastics (31H1 and 31H2); Composite (31HZ1 and 31HA2, 31HB2, 31HN2, 31HD2 and 31HH2). Additional Requirement: Only liquids with a vapor pressure less than or equal to 110 kPa at 50 C (1.1 bar at 122 F), or 130 kPa at 55 C (1.3 bar at 131 F) are authorized, except for UN2672 (also see Special Provision IP8 in Table 2 for UN2672).
T2 - 1.5 178.274(d)(2) Normal..... 178.275(d)(3)
TP1 - The maximum degree of filling must not exceed the degree of filling determined by the following: Degree of filling = $97 / 1 + a (tr - tf)$ Where: tr is the maximum mean bulk temperature during transport, and tf is the temperature in degrees celsius of the liquid during filling.
- DOT Packaging Exceptions (49 CFR 173.xxx) : 150
- DOT Packaging Non Bulk (49 CFR 173.xxx) : 203
- DOT Packaging Bulk (49 CFR 173.xxx) : 242
- DOT Quantity Limitations Passenger aircraft/rail (49 CFR 173.27) : 60 L
- DOT Quantity Limitations Cargo aircraft only (49 CFR 175.75) : 220 L
- DOT Vessel Stowage Location : A - The material may be stowed "on deck" or "under deck" on a cargo vessel and on a passenger vessel.

Additional information

- Other information : No supplementary information available.

ADR

- Transport document description : UN 1307, 3, III, (D/E)
- Packing group (ADR) : III
- Class (ADR) : 3 - Flammable liquid
- Hazard identification number (Kemler No.) : 30
- Classification code (ADR) : F1

Xylenes

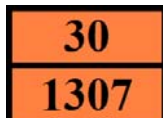
Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

Hazard labels (ADR) : 3 - Flammable liquids



Orange plates :



Tunnel restriction code : D/E

Transport by sea

UN-No. (IMDG) : 1307
Class (IMDG) : 3 - Flammable liquids
EmS-No. (1) : F-E
EmS-No. (2) : S-D

Air transport

UN-No.(IATA) : 1307
Class (IATA) : 3 - Flammable Liquids
Packing group (IATA) : III - Minor Danger

SECTION 15: Regulatory information

15.1. US Federal regulations

Xylenes (1330-20-7)

Listed on the United States TSCA (Toxic Substances Control Act) inventory
Listed on United States SARA Section 313

RQ (Reportable quantity, section 304 of EPA's List of Lists) 100 lb

SARA Section 311/312 Hazard Classes Fire hazard

15.2. International regulations

CANADA

Xylenes (1330-20-7)

WHMIS Classification Class B Division 2 - Flammable Liquid
Class D Division 2 Subdivision B - Toxic material causing other toxic effects

EU-Regulations

No additional information available

Classification according to Regulation (EC) No. 1272/2008 [CLP]

Flam. Liq. 3 H226
Acute Tox. 4 (Inhalation) H332
Acute Tox. 4 (Dermal) H312
Skin Irrit. 2 H315

Full text of H-phrases: see section 16

Classification according to Directive 67/548/EEC [DSD] or 1999/45/EC [DPD]

R10
Xn; R20/21
Xi; R38

Full text of R-phrases: see section 16

15.2.2. National regulations

No additional information available

Xylenes

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

15.3. US State regulations

Xylenes(1330-20-7)

U.S. - California - Proposition 65 - Carcinogens List	No
U.S. - California - Proposition 65 - Developmental Toxicity	No
U.S. - California - Proposition 65 - Reproductive Toxicity - Female	No
U.S. - California - Proposition 65 - Reproductive Toxicity - Male	No

SECTION 16: Other information

Full text of H-phrases: see section 16:

Aquatic Acute 2	Hazardous to the aquatic environment - Acute Hazard Category 2
Flam. Liq. 3	Flammable liquids Category 3
Skin Irrit. 2	Skin corrosion/irritation Category 2
H226	Flammable liquid and vapor
H315	Causes skin irritation
H401	Toxic to aquatic life

NFPA health hazard

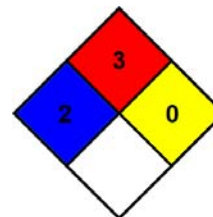
: 2 - Intense or continued exposure could cause temporary incapacitation or possible residual injury unless prompt medical attention is given.

NFPA fire hazard

: 3 - Liquids and solids that can be ignited under almost all ambient conditions.

NFPA reactivity

: 0 - Normally stable, even under fire exposure conditions, and are not reactive with water.



HMIS III Rating

Health

: 2 Moderate Hazard - Temporary or minor injury may occur

Flammability

: 3 Serious Hazard

Physical

: 0 Minimal Hazard

Personal Protection

: H

SDS US ValTech

Information in this SDS is from available published sources and is believed to be accurate. No warranty, express or implied, is made and LabChem Inc assumes no liability resulting from the use of this SDS. The user must determine suitability of this information for his application.

International Chemical Safety Cards

DIESEL FUEL No. 2

ICSC: 1561



Fuels, Diesel, No. 2
Diesel oil No. 2
Gasoil - unspecified

ICSC # 1561

CAS # 68476-34-6

RTECS # [LS9142500](#)

UN # 1202

EC # 649-227-00-2

October 26, 2004 Validated



TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Flammable. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames.	Water spray, alcohol-resistant foam, dry powder, carbon dioxide.
EXPLOSION	Above 52°C explosive vapour/air mixtures may be formed.	Above 52°C use a closed system, ventilation, and explosion-proof electrical equipment.	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE			
•INHALATION	Dizziness. Headache. Nausea.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
•SKIN	Dry skin. Redness.	Protective gloves.	Rinse and then wash skin with water and soap.
•EYES	Redness. Pain.	Safety goggles, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION	(See Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Do NOT induce vomiting. Refer for medical attention.
SPILLAGE DISPOSAL		STORAGE	PACKAGING & LABELLING
Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Personal protection: filter respirator for organic gases and vapours.		Well closed.	Note: H Xn symbol R: 40 S: 2-36/37 UN Hazard Class: 3 UN Packing Group: III
SEE IMPORTANT INFORMATION ON BACK			


ICSC: 1561

Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

International Chemical Safety Cards

DIESEL FUEL No. 2

ICSC: 1561

<p>I M P O R T A N T D A T A</p>	<p>PHYSICAL STATE; APPEARANCE: BROWN SLIGHTLY VISCOUS LIQUID , WITH CHARACTERISTIC ODOUR.</p> <p>PHYSICAL DANGERS:</p> <p>CHEMICAL DANGERS:</p> <p>OCCUPATIONAL EXPOSURE LIMITS: TLV: 100 ppm as TWA; (skin); A3; (ACGIH 2004).</p>	<p>ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation of its aerosol.</p> <p>INHALATION RISK: A harmful contamination of the air will not or will only very slowly be reached on evaporation of this substance at 20°C.</p> <p>EFFECTS OF SHORT-TERM EXPOSURE: The substance is irritating to the eyes , the skin and the respiratory tract . The substance may cause effects on the central nervous system. If this liquid is swallowed, aspiration into the lungs may result in chemical pneumonitis.</p> <p>EFFECTS OF LONG-TERM OR REPEATED EXPOSURE: The liquid defats the skin.</p>
<p>PHYSICAL PROPERTIES</p>	<p>Boiling point: 282-338°C Melting point: -30 - -18°C Density: 0.87 - 0.95 g/cm³ Solubility in water, g/100 ml at 20°C: 0.0005 Flash point: 52°C c.c.</p> <p>Auto-ignition temperature: 254-285°C Explosive limits, vol% in air: 0.6 - 6.5 Octanol/water partition coefficient as log Pow: > 3.3</p>	
<p>ENVIRONMENTAL DATA</p>	<p>The substance is harmful to aquatic organisms.</p> 	
<p>NOTES</p>		
<p>Additives to Diesel fuel in winter may change physical and toxicological properties of the substance. This card does not address Diesel exhaust.</p> <p>Transport Emergency Card: TEC (R)-30S1202</p> <p>NFPA Code: H0; F2; R0;</p>		
<p>ADDITIONAL INFORMATION</p>		
<p></p>		
<p>ICSC: 1561</p>	<p>DIESEL FUEL No. 2</p>	

(C) IPCS, CEC, 1994

**IMPORTANT
LEGAL
NOTICE:**

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International Chemical Safety Cards

POLYCHLORINATED BIPHENYL (AROCLOR 1254)

ICSC: 0939

<p>POLYCHLORINATED BIPHENYL (AROCLOR 1254) Chlorobiphenyl (54% chlorine) Chlorodiphenyl (54% chlorine) PCB Molecular mass: 327 (average)</p> <p>CAS # 11097-69-1 RTECS # TQ1360000 ICSC # 0939 UN # 2315 EC # 602-039-00-4</p>			
TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Not combustible. Irritating and toxic gases may be generated in a fire.		Powder, carbon dioxide.
EXPLOSION			
EXPOSURE		PREVENT GENERATION OF MISTS! STRICT HYGIENE!	
• INHALATION		Ventilation.	Fresh air, rest. Refer for medical attention.
• SKIN	MAY BE ABSORBED! Dry skin. Redness. Chloracne (further see Inhalation).	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention.
• EYES	Redness. Pain.	Safety goggles, face shield.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• INGESTION	Headache. Numbness. Fever.	Do not eat, drink, or smoke during work.	Rest. Refer for medical attention.
SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING	
Consult an expert! Collect leaking liquid in sealable containers. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT let this chemical enter the environment (extra personal protection: complete protective clothing including self-contained breathing apparatus).	Separated from food and feedstuffs. Cool. Dry. Keep in a well-ventilated room.	Unbreakable packaging; put breakable packaging into closed unbreakable container. Do not transport with food and feedstuffs. Xn symbol R: 33 S: 35 Note: C UN Hazard Class: 9	

		UN Packing Group: II
SEE IMPORTANT INFORMATION ON BACK		
ICSC: 0939	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities © IPCS CEC 1993	

International Chemical Safety Cards

POLYCHLORINATED BIPHENYL (AROCLOR 1254)

ICSC: 0939

I M P O R T A N T D A T A	PHYSICAL STATE; APPEARANCE: LIGHT YELLOW VISCOUS LIQUID.	ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation of its aerosol, through the skin and by ingestion.
	PHYSICAL DANGERS:	INHALATION RISK: A harmful contamination of the air will be reached rather slowly on evaporation of this substance at 20°C.
	CHEMICAL DANGERS: The substance decomposes in a fire producing irritating and toxic gases.	EFFECTS OF SHORT-TERM EXPOSURE: The substance irritates the eyes (see Notes).
	OCCUPATIONAL EXPOSURE LIMITS (OELs): TLV: ppm; 0.5 mg/m ³ (skin) (ACGIH 1991-1992).	EFFECTS OF LONG-TERM OR REPEATED EXPOSURE: Repeated or prolonged contact with skin may cause dermatitis chloracne. The substance may have effects on the liver. Animal tests show that this substance possibly causes toxic effects upon human reproduction.
	PHYSICAL PROPERTIES	Relative density (water = 1): 1.5 Solubility in water: none
ENVIRONMENTAL DATA	In the food chain important to humans, bioaccumulation takes place, specifically in water organisms. It is strongly advised not to let the chemical enter into the environment.	
NOTES		
Changes into a resinous state (pour point) at 10°C. Distillation range: 365°-390°C. No open cup flash point to boiling. The symptoms other than the chloracne and liver effects may be in part due to contaminants of the PCB. Transport Emergency Card: TEC (R)-914		
ADDITIONAL INFORMATION		
ICSC: 0939 POLYCHLORINATED BIPHENYL (AROCLOR 1254) © IPCS, CEC, 1993		
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International Chemical Safety Cards

2-METHOXY-2-METHYL PROPANE

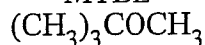
ICSC: 1164

2-METHOXY-2-METHYL PROPANE

tert-Butyl methyl ether

Methyl tert-butyl ether

MTBE



Molecular mass: 88.2

CAS # 1634-04-4

RTECS # KN5250000

ICSC # 1164

UN # 2398

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Highly flammable.	NO open flames, NO sparks, and NO smoking. NO contact with oxidants.	Water spray. Alcohol-resistant foam. Carbon dioxide.
EXPLOSION	Vapour/air mixtures are explosive. Risk of fire and explosion.	Prevent build-up of electrostatic charges (e.g., by grounding).	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE			
• INHALATION	Cough. Dizziness. Unconsciousness. Weakness.	Ventilation.	Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.
• SKIN	Dry skin.	Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
• EYES	Redness. Pain.	Safety goggles or face shield.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• INGESTION	Abdominal pain. Dizziness. Nausea. Vomiting.	Do not eat, drink, or smoke during work.	Rinse mouth. Give a slurry of activated charcoal in water to drink. Do NOT induce vomiting. Refer for medical attention.
SPILLAGE DISPOSAL		STORAGE	PACKAGING & LABELLING
Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT wash away into sewer. Use self-contained breathing apparatus in the case of large spills.		Fireproof. Separated from strong oxidants, strong acids. Keep in a well-ventilated room.	UN Haz Class: 3 UN Pack Group: II
SEE IMPORTANT INFORMATION ON BACK			
ICSC: 1164		Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities © IPCS CEC 1993	

International Chemical Safety Cards

2-METHOXY-2-METHYL PROPANE

ICSC: 1164

I M P O R T A N T D A T A	PHYSICAL STATE; APPEARANCE: COLOURLESS LIQUID , WITH CHARACTERISTIC ODOUR.		ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation and by ingestion.	
	PHYSICAL DANGERS: The vapour is heavier than air and may travel along the ground; distant ignition possible. The vapour mixes well with air, explosive mixtures are easily formed. As a result of flow, agitation, etc., electrostatic charges can be generated.		INHALATION RISK:	
	CHEMICAL DANGERS: Reacts violently with strong oxidants causing fire hazard.		EFFECTS OF SHORT-TERM EXPOSURE: Inhalation of high concentrations of vapour may cause irritation of respiratory tract. Exposure to high concentrations could cause lowering of consciousness.	
	OCCUPATIONAL EXPOSURE LIMITS (OELs): TLV not established.		EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:	
PHYSICAL PROPERTIES	Boiling point: 55°C Melting point: -109°C Relative density (water = 1): 0.7 Solubility in water, g/100 ml: 4.8 Solubility in water: 6.9% by volume Vapour pressure, kPa at 25°C: 32.7		Relative vapour density (air = 1): 3.0 Relative density of the vapour/air-mixture at 20°C (air = 1): 1.7 Flash point: -28°C Auto-ignition temperature: 224°C Explosive limits, vol% in air: 1.6-15.1 Octanol/water partition coefficient as log Pow: 1.3	
ENVIRONMENTAL DATA				
NOTES				
Other explosive limits: 1.6-8.4 volume %. Much less likely to form peroxides than other ethers. Transport Emergency Card: TEC (R)-30G30				
ADDITIONAL INFORMATION				
ICSC: 1164		2-METHOXY-2-METHYL PROPANE		
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Material Safety Data Sheet

Arsenic 100 ppm

ACC# 88076

Section 1 - Chemical Product and Company Identification

MSDS Name: Arsenic 100 ppm**Catalog Numbers:** MCC-031368**Synonyms:** None**Company Identification:**

Fisher Scientific

1 Reagent Lane

Fair Lawn, NJ 07410

For information, call: 201-796-7100**Emergency Number:** 201-796-7100**For CHEMTREC assistance, call:** 800-424-9300**For International CHEMTREC assistance, call:** 703-527-3887

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
7732-18-5	Water	7732-18-	231-791-2
7664-93-9	Sulfuric Acid	<2.0%	231-639-5
1310-73-2	Sodium Hydroxide	<1.0%	215-185-5
1327-53-3	Arsenic trioxide	<1.0%	215-481-4

Hazard Symbols: None listed.**Risk Phrases:** None listed.

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: Not available. May cause skin irritation. May cause respiratory and digestive tract irritation. May cause severe eye irritation and possible injury. May cause fetal effects. **Danger!** Contains inorganic arsenic. Cancer hazard. Harmful if inhaled or swallowed. Use only with adequate ventilation or respiratory protection.

Target Organs: None.**Potential Health Effects****Eye:** May cause severe eye irritation. May result in corneal injury.**Skin:** May cause skin irritation.**Ingestion:** May cause irritation of the digestive tract.**Inhalation:** May cause respiratory tract irritation.**Chronic:** May cause fetal effects.

Section 4 - First Aid Measures

Eyes: Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid immediately.

Skin: Get medical aid if irritation develops or persists. Flush skin with plenty of soap and water.

Ingestion: If victim is conscious and alert, give 2-4 cupfuls of milk or water. Get medical aid immediately.

Inhalation: Get medical aid immediately. Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.

Notes to Physician: Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear.

Extinguishing Media: Use water fog, dry chemical, carbon dioxide, or regular foam.

Flash Point: Not available.

Autoignition Temperature: Not available.

Explosion Limits, Lower: Not available.

Upper: Not available.

NFPA Rating: Not published.

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks: Absorb spill with inert material (e.g. vermiculite, sand or earth), then place in suitable container.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use only in a well-ventilated area. Do not get on skin or in eyes. Avoid ingestion and inhalation.

Storage: Store in a cool, dry place.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Water	none listed	none listed	none listed
	0.2 mg/m3 TWA (thoracic	1 mg/m3 TWA 15 mg/m3	

Sulfuric Acid	particulate mass); 3 mg/m ³ STEL	IDLH	1 mg/m ³ TWA
Sodium Hydroxide	2 mg/m ³ Ceiling	10 mg/m ³ IDLH	2 mg/m ³ TWA
Arsenic trioxide	none listed	none listed	none listed

OSHA Vacated PELs: Water: No OSHA Vacated PELs are listed for this chemical. Sulfuric Acid: 1 mg/m³ TWA Sodium Hydroxide: No OSHA Vacated PELs are listed for this chemical. Arsenic trioxide: No OSHA Vacated PELs are listed for this chemical.

Personal Protective Equipment

Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin: Wear appropriate protective gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to minimize contact with skin.

Respirators: Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

Section 9 - Physical and Chemical Properties

Physical State: Liquid

Appearance: Not available.

Odor: none reported

pH: Not available.

Vapor Pressure: Not available.

Vapor Density: Not available.

Evaporation Rate: Not available.

Viscosity: Not available.

Boiling Point: Not available.

Freezing/Melting Point: Not available.

Decomposition Temperature: Not available.

Solubility: Not available.

Specific Gravity/Density: Not available.

Molecular Formula: Mixture

Molecular Weight: Not available

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.

Conditions to Avoid: None reported.

Incompatibilities with Other Materials: None reported.

Hazardous Decomposition Products: Oxides of arsenic, arsine.

Hazardous Polymerization: Has not been reported.

Section 11 - Toxicological Information

RTECS#:

CAS# 7732-18-5; ZC0110000

CAS# 7664-93-9: WS5600000

CAS# 1310-73-2: WB4900000

CAS# 1327-53-3: CG3325000

LD50/LC50:

CAS# 7732-18-5:

Oral, rat: LD50 = >90 mL/kg;

CAS# 7664-93-9:

Draize test, rabbit, eye: 250 ug Severe;

Inhalation, mouse: LC50 = 320 mg/m³/2H;

Inhalation, mouse: LC50 = 320 mg/m³;

Inhalation, rat: LC50 = 510 mg/m³/2H;

Inhalation, rat: LC50 = 510 mg/m³;

Oral, rat: LD50 = 2140 mg/kg;

CAS# 1310-73-2:

Draize test, rabbit, eye: 400 ug Mild;

Draize test, rabbit, eye: 1% Severe;

Draize test, rabbit, eye: 50 ug/24H Severe;

Draize test, rabbit, eye: 1 mg/24H Severe;

Draize test, rabbit, skin: 500 mg/24H Severe;

CAS# 1327-53-3:

Oral, mouse: LD50 = 20 mg/kg;

Oral, rabbit: LD50 = 20190 ug/kg;

Oral, rat: LD50 = 10 mg/kg;

Carcinogenicity:

CAS# 7732-18-5: Not listed by ACGIH, IARC, NIOSH, NTP, or OSHA. **CAS# 7664-93-9:**

ACGIH: A2 - Suspected Human Carcinogen (contained in strong inorganic acid mists)

OSHA: Select carcinogen

IARC: Group 1 carcinogen **CAS# 1310-73-2:** Not listed by ACGIH, IARC, NIOSH, NTP, or OSHA.

CAS# 1327-53-3:

ACGIH: A1 - Confirmed Human Carcinogen (listed as 'Arsenic').

California: carcinogen, initial date 2/27/87 (listed as Arsenic, inorganic compounds).

NIOSH: potential occupational carcinogen (listed as Arsenic)

NTP: Known carcinogen (listed as Arsenic, inorganic compounds).

OSHA: Select carcinogen (listed as Arsenic).

IARC: Group 1 carcinogen (listed as Arsenic).

Epidemiology: In a large number of studies, exposure to inorganic arsenic compounds in drugs, food, and water as well as in an occupational setting have been casually associated with the development of cancer, primarily of the skin and lungs.

Teratogenicity: Teratogenic effects, including exencephaly, skeletal defects, and genitourinary system defects have occurred when arsenic compounds were administered intravenously or intraperitoneally at high doses in hamsters, rats and mice.

Section 12 - Ecological Information

No information available.

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

RCRA P-Series: CAS# 1327-53-3: waste number P012.

RCRA U-Series: None listed.

Section 14 - Transport Information

	US DOT	IATA	RID/ADR	IMO	Canada TDG
Shipping Name:	No information available.				No information available.
Hazard Class:					
UN Number:					
Packing Group:					

Section 15 - Regulatory Information

US FEDERAL

TSCA

CAS# 7732-18-5 is listed on the TSCA inventory.

CAS# 7664-93-9 is listed on the TSCA inventory.

CAS# 1310-73-2 is listed on the TSCA inventory.

CAS# 1327-53-3 is listed on the TSCA inventory.

Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

Section 12b

None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

SARA

CERCLA Hazardous Substances and corresponding RQs

CAS# 7664-93-9: 1000 lb final RQ; 454 kg final RQ CAS# 1310-73-2: 1000 lb final RQ; 454 kg final RQ CAS# 1327-53-3: 1 lb final RQ; 0.454 kg final RQ

SARA Section 302 Extremely Hazardous Substances

CAS# 7664-93-9: 1000 lb TPQ CAS# 1327-53-3: 100 lb TPQ (lower threshold); 10000 lb TPQ (upper threshold)

SARA Codes

CAS # 7664-93-9: acute, chronic, reactive. CAS # 1310-73-2: acute, reactive. CAS # 1327-53-3: acute, chronic.

Section 313

This material contains Sulfuric Acid (CAS# 7664-93-9, 2 0%), which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373. This material contains Arsenic trioxide (listed as Arsenic), 1 0%, (CAS# 1327-53-3) which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

Clean Air Act:

This material does not contain any hazardous air pollutants. This material does not contain any Class 1 Ozone depleters. This material does not contain any Class 2 Ozone depleters.

Clean Water Act:

CAS# 7664-93-9 is listed as a Hazardous Substance under the CWA. CAS# 1310-73-2 is listed as a

Hazardous Substance under the CWA. CAS# 1327-53-3 is listed as a Hazardous Substance under the CWA. None of the chemicals in this product are listed as Priority Pollutants under the CWA. None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

CAS# 7732-18-5 is not present on state lists from CA, PA, MN, MA, FL, or NJ.

CAS# 7664-93-9 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

CAS# 1310-73-2 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

CAS# 1327-53-3 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Massachusetts.

WARNING: This product contains Arsenic trioxide, listed as 'Arsenic (inorganic oxides)', a chemical known to the state of California to cause birth defects or other reproductive harm. California No Significant Risk Level: None of the chemicals in this product are listed.

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:

Not available.

Risk Phrases:

Safety Phrases:

WGK (Water Danger/Protection)

CAS# 7732-18-5: No information available.

CAS# 7664-93-9: 2

CAS# 1310-73-2: 1

CAS# 1327-53-3: 3

Canada - DSL/NDL

CAS# 7732-18-5 is listed on Canada's DSL List.

CAS# 7664-93-9 is listed on Canada's DSL List.

CAS# 1310-73-2 is listed on Canada's DSL List.

CAS# 1327-53-3 is listed on Canada's DSL List.

Canada - WHMIS

WHMIS: Not available.

Canadian Ingredient Disclosure List

CAS# 7664-93-9 is listed on the Canadian Ingredient Disclosure List.

CAS# 1310-73-2 is listed on the Canadian Ingredient Disclosure List.

CAS# 1327-53-3 is listed on the Canadian Ingredient Disclosure List.

Exposure Limits

CAS# 7664-93-9: OEL-ARAB Republic of Egypt:TWA 1 mg/m3 OEL-AUSTRALI

A:TWA 1 mg/m3 OEL-BELGIUM:TWA 1 mg/m3;STEL 3 mg/m3 OEL-CZECHOSLOVAKI

A:TWA 1 mg/m3;STEL 2 mg/m3 OEL-DENMARK:TWA 1 mg/m3 OEL-FINLAND:TWA 1

mg/m3;STEL 3 mg/m3;Skin OEL-FRANCE:TWA 1 mg/m3;STEL 3 mg/m3 OEL-GER

MANY:TWA 1 mg/m3 OEL-HUNGARY:STEL 1 mg/m3 OEL-JAPAN:TWA 1 mg/m3 OEL

-THE NETHERLANDS:TWA 1 mg/m3 OEL-THE PHILIPPINES:TWA 1 mg/m3 OEL-POL

AND:TWA 1 mg/m3 OEL-RUSSIA:STEL 1 mg/m3;Skin OEL-SWEDEN:TWA 1 mg/m3;

STEL 3 mg/m3 OEL-SWITZERLAND:TWA 1 mg/m3;STEL 2 mg/m3 OEL-THAILAND:T

WA 1 mg/m3 OEL-TURKEY:TWA 1 mg/m3 OEL-UNITED KINGDOM:TWA 1 mg/m3 OE

L IN BULGARIA, COLOMBIA, JORDAN, KOREA check ACGIH TLV OEL IN NEW ZEA

LAND, SINGAPORE, VIETNAM check ACGI TLV

CAS# 1310-73-2: OEL-AUSTRALIA:TWA 2 mg/m3 OEL-BELGIUM:STEL 2 mg/m3

OEL-DENMARK:TWA 2 mg/m3 OEL-FINLAND:TWA 2 mg/m3 OEL-FRANCE:TWA 2 mg

/m3 OEL-GERMANY:TWA 2 mg/m3 OEL-JAPAN:STEL 2 mg/m3 OEL-THE NETHERLANDS:TWA 2 mg/m3 OEL-THE PHILIPPINES:TWA 2 mg/m3 OEL-SWEDEN:TWA 2 mg/m3 OEL-SWITZERLAND:TWA 2 mg/m3;STEL 4 mg/m3 OEL-THAILAND:TWA 2 mg/m3 OEL-TURKEY:TWA 2 mg/m3 OEL-UNITED KINGDOM:TWA 2 mg/m3;STEL 2 mg/m3 OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA check ACGIH TLV OEL IN NEW ZEALAND, SINGAPORE, VIETNAM check ACGI TLV
 CAS# 1327-53-3: OEL-AUSTRALIA;Carcinogen OEL-BELGIUM;Carcinogen OEL-FINLAND;Carcinogen OEL-FRANCE:STEL 0.2 ppm;Carcinogen OEL-GERMANY;Carcinogen OEL-JAPAN:STEL 0.5 ppm;Carcinogen OEL-THE PHILIPPINES:TWA 0.1 mg/m3;Carcinogen JAN9 OEL-SWITZERLAND:TWA 0.15 mg/m3 OEL-UNITED KINGDOM:TWA 0.1 mg/m3 OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA check ACGIH TLV OEL IN NEW ZEALAND, SINGAPORE, VIETNAM check ACGI TLV OEL-ARAB Republic of Egypt:TWA 0.2 mg(As)/m3 OEL-ARAB Republic of Egypt:TWA 0.2 mg(Se)/m3 JAN9 OEL-AUSTRALIA:TWA 0.05 mg(As)/m3;Carcinogen OEL-AUSTRALIA:TWA 0.2 mg(Se)/m3 OEL-BELGIUM:TWA 0.2 mg(As)/m3 OEL-BELGIUM:TWA 0.2 mg(Se)/m3 OEL-CZECHOSLOVAKIA:TWA 0.2 mg(As)/m3;STEL 0.6 mg(As)/m3 OEL-DENMARK:TWA 0.05 mg(As)/m3 OEL-DENMARK:TWA 0.1 mg(Se)/m3 OEL-FINLAND:TWA 0.1 mg(Se)/m3;STEL 0.3 mg(Se)/m3 OEL-FINLAND;Carcinogen OEL-FRANCE:TWA 0.2 mg(As)/m3 OEL-GERMANY:TWA 0.1 mg(Se)/m3 OEL-HUNGARY:STEL 0.1 mg(Se)/m3 OEL-HUNGARY:STEL 0.5 mg(As)/m3;Carcinogen OEL-INDIA:TWA 0.2 mg(As)/m3 OEL-THE NETHERLANDS:TWA 0.2 mg(Se)/m3 OEL-THE PHILIPPINES:TWA 0.2 mg(Se)/m3 OEL-THE PHILIPPINES:TWA 0.5 mg(As)/m3 OEL-POLAND:TWA 0.1 mg(Se)/m3 OEL-POLAND:TWA 0.3 mg(As)/m3 OEL-SWEDEN:TWA 0.03 mg(As)/m

Section 16 - Additional Information

MSDS Creation Date: 8/24/1997

Revision #2 Date: 3/18/2003

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

MSDS Number: B0335 * * * * * Effective Date: 06/26/00 * * * * * Supersedes: 05/20/97

MSDS**Material Safety Data Sheet**

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865



24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. And Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-562-2537) for assistance.

Barium, 1000 ug/mL (0.10% w/v)

1. Product Identification

Synonyms: None

CAS No.: Not applicable to mixtures.

Molecular Weight: 137.33

Chemical Formula: BaCO₃ and HNO₃ in H₂O

Product Codes: 6920

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Barium Carbonate	513-77-9	< 1%	No
Nitric Acid	7697-37-2	1 - 2%	Yes
Water	7732-18-5	97 - 98%	No

3. Hazards Identification

Emergency Overview

DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED. VAPOR IRRITATING TO EYES AND RESPIRATORY TRACT. INHALATION MAY CAUSE LUNG AND TOOTH DAMAGE.

J.T. Baker SAF-T-DATA^(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Life)

Flammability Rating: 0 - None

Reactivity Rating: 1 - Slight

Contact Rating: 3 - Severe (Corrosive)

Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES

Storage Color Code: White (Corrosive)

Potential Health Effects

Nitric acid is extremely hazardous; it is corrosive, reactive, an oxidizer, and a poison. The following hazards are for concentrated solutions. Hazards of less concentrated solutions may be reduced. Degree of hazard for reduced concentrations is not currently addressed in the available literature.

Inhalation:

Corrosive! Inhalation of vapors can cause coughing, choking, inflammation of the nose, throat, and upper respiratory tract, and in severe cases, pulmonary edema, circulatory failure, and death.

Ingestion:

Corrosive! Swallowing can cause immediate pain and burns of the mouth, throat, esophagus and gastrointestinal tract. May cause nausea, vomiting, and diarrhea, and in severe cases, death.

Skin Contact:

Corrosive! Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and stain skin a yellow or yellow-brown color.

Eye Contact:

Corrosive! Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.

Chronic Exposure:

Long-term exposure to concentrated vapors may cause erosion of teeth and lung damage. Long-term exposures seldom occur due to the corrosive properties of the acid.

Aggravation of Pre-existing Conditions:

Persons with pre-existing skin disorders, eye disease, or cardiopulmonary diseases may be more susceptible to the effects of this substance.

4. First Aid Measures

Immediate first aid treatment reduces the health effects of this substance.

Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Ingestion:

If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Skin Contact:

Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention immediately. Wash clothing before reuse. Thoroughly clean shoes before reuse.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:

Not combustible, but concentrated material is a strong oxidizer and its heat of reaction with reducing agents or combustibles may cause ignition.

Explosion:

Concentrated material reacts explosively with combustible organic or readily oxidizable materials such as: alcohols, turpentine, charcoal, organic refuse, metal powder, hydrogen sulfide, etc. Reacts with most metals to release hydrogen gas which can form explosive mixtures with air.

Fire Extinguishing Media:

Use any means suitable for extinguishing surrounding fire.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Neutralize with alkaline material (soda ash, lime), then absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Store in a cool, dry, ventilated storage area with acid resistant floors and good drainage. Protect from physical damage. Keep out of direct sunlight and away from heat, water, and incompatible materials. Do not wash out container and use it for other purposes. When diluting, the acid should always be added slowly to water and in small amounts. Never use hot water and never add water to the acid. Water added to acid can cause uncontrolled boiling and splashing. When opening metal containers, use non-sparking tools because of the possibility of hydrogen gas being present. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

For Nitric Acid:

OSHA Permissible Exposure Limit (PEL):

2 ppm (TWA)

ACGIH Threshold Limit Value (TLV):

2 ppm (TWA); 4 ppm (STEL)

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus. Canister-type respirators using sorbents are ineffective.

Skin Protection:

Rubber or neoprene gloves and additional protection including impervious boots, apron, or coveralls, as needed in areas of unusual exposure to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:

Clear, colorless liquid.

Odor:

Odorless.

Solubility:

Complete (100%)

Specific Gravity:

No information found.

pH:

No information found.

% Volatiles by volume @ 21C (70F):

ca. 99

Boiling Point:

No information found.

Melting Point:

No information found.

Vapor Density (Air=1):

No information found.

Vapor Pressure (mm Hg):

No information found.

Evaporation Rate (BuAc=1):

No information found.

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage.

Hazardous Decomposition Products:

When heated to decomposition, emits toxic nitrogen oxides fumes and hydrogen nitrate.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

A dangerously powerful oxidizing agent, concentrated nitric acid is incompatible with most substances, especially strong bases, metallic powders, carbides, hydrogen sulfide, turpentine, and combustible organics.

Conditions to Avoid:

Heat and incompatibles.

11. Toxicological Information

For Nitric Acid: Investigated as a mutagen and reproductive effector.

-----\Cancer Lists\-----			
Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Barium Carbonate (513-77-9)	No	No	None
Nitric Acid (7697-37-2)	No	No	None
Water (7732-18-5)	No	No	None

12. Ecological Information

Environmental Fate:

No information found.

Environmental Toxicity:

No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S.
(NITRIC ACID)

Hazard Class: 8**UN/NA:** UN3264**Packing Group:** III**Information reported for product/size:** 500ML**International (Water, I.M.O.)**

Proper Shipping Name: CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S.
(NITRIC ACID)

Hazard Class: 8**UN/NA:** UN3264**Packing Group:** III**Information reported for product/size:** 500ML**International (Air, I.C.A.O.)**

Proper Shipping Name: CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S.
(NITRIC ACID)

Hazard Class: 8**UN/NA:** UN3264**Packing Group:** III**Information reported for product/size:** 500ML

15. Regulatory Information

-----\Chemical Inventory Status - Part 1\-----

Ingredient	TSCA	EC	Japan	Australia
Barium Carbonate (513-77-9)	Yes	Yes	Yes	Yes
Nitric Acid (7697-37-2)	Yes	Yes	Yes	Yes
Water (7732-18-5)	Yes	Yes	Yes	Yes

-----\Chemical Inventory Status - Part 2\-----

Ingredient	Korea	--Canada--		
		DSL	NDSL	Phil.
Barium Carbonate (513-77-9)	Yes	Yes	No	Yes
Nitric Acid (7697-37-2)	Yes	Yes	No	Yes
Water (7732-18-5)	Yes	Yes	No	Yes

-----\Federal, State & International Regulations - Part 1\-----

Ingredient	-SARA 302-		-----SARA 313-----	
	RQ	TPQ	List	Chemical Catg.
Barium Carbonate (513-77-9)	No	No	No	Barium compo
Nitric Acid (7697-37-2)	1000	1000	Yes	No
Water (7732-18-5)	No	No	No	No

-----\Federal, State & International Regulations - Part 2\-----

Ingredient	CERCLA	-RCRA-	-TSCA-
		261.33	8 (d)
Barium Carbonate (513-77-9)	No	No	No
Nitric Acid (7697-37-2)	1000	No	No
Water (7732-18-5)	No	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
 SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
 Reactivity: No (Mixture / Liquid)

Australian Hazchem Code: None allocated.

Poison Schedule: S6

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: 3 Flammability: 0 Reactivity: 0

Label Hazard Warning:

DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL

BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED. VAPOR IRRITATING TO EYES AND RESPIRATORY TRACT. INHALATION MAY CAUSE LUNG AND TOOTH DAMAGE.

Label Precautions:

Do not get in eyes, on skin, or on clothing.

Do not breathe vapor or mist.

Use only with adequate ventilation.

Wash thoroughly after handling.

Keep container closed.

Label First Aid:

In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. In all cases get medical attention immediately.

Product Use:

Laboratory Reagent.

Revision Information:

MSDS Section(s) changed since last revision of document include: 3, 14, 16.

Disclaimer:

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Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

Material Safety Data Sheet

Cadmium metal, granular

ACC# 03720

Section 1 - Chemical Product and Company Identification

MSDS Name: Cadmium metal, granular**Catalog Numbers:** AC612135000, S79935, C3-500**Synonyms:** None.**Company Identification:**

Fisher Scientific

1 Reagent Lane

Fair Lawn, NJ 07410

For information, call: 201-796-7100**Emergency Number:** 201-796-7100**For CHEMTREC assistance, call:** 800-424-9300**For International CHEMTREC assistance, call:** 703-527-3887

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
7440-43-9	Cadmium	100	231-152-8

Hazard Symbols: T+ F**Risk Phrases:** 11 25 26 45

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: silver white granules. Inhalation of fumes may cause metal-fume fever. Flammable solid. Air sensitive. May cause reproductive and fetal effects. Harmful if swallowed. May be fatal if inhaled. **Danger!** Causes eye, skin, and respiratory tract irritation. Contains cadmium. Avoid creating dust. Can cause lung and kidney disease. Cancer hazard.

Target Organs: Blood, kidneys, liver, lungs, skeletal structures, prostate.

Potential Health Effects**Eye:** Causes eye irritation.**Skin:** Causes skin irritation.

Ingestion: Harmful if swallowed. May cause gastrointestinal irritation with nausea, vomiting and diarrhea. Ingestion may produce fluid loss, acute renal failure, and cardiopulmonary depression.

Inhalation: May be fatal if inhaled. Inhalation of fumes may cause metal fume fever, which is characterized by flu-like symptoms with metallic taste, fever, chills, cough, weakness, chest pain, muscle pain and increased white blood cell count. Damage may be delayed. May cause nausea, vomiting, abdominal pain, diarrhea, chest tightness, weakness, and delayed pulmonary edema. In humans inhalation causes proteinuria, an excess of protein in the urine.

Chronic: May cause respiratory tract cancer. Repeated inhalation may cause chronic bronchitis. Chronic inhalation may cause nasal septum ulceration and perforation. Cadmium and compounds

may cause lung, liver and kidney damage and lung and prostate cancer in humans. May cause loss of smell, emphysema, anemia, bone demineralization, and lung fibrosis. The primary target organ for chronic cadmium disease is clearly the kidney.

Section 4 - First Aid Measures

Eyes: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.

Skin: Get medical aid. Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.

Ingestion: Do not induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.

Inhalation: POISON material. If inhaled, get medical aid immediately. Remove victim to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Attempt rescue only after notifying at least one other person of the emergency and putting into effect established emergency procedures. Do not become a casualty yourself.

Notes to Physician: Administration of calcium disodium EDTA may be useful in acute poisoning with its use at the discretion of qualified medical personnel. Persons with kidney disease, chronic respiratory disease, liver disease, or skin disease may be at increased risk from exposure to this substance.

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Material can spontaneously ignite (pyrophoric) when exposed to air at normal or slightly elevated temperatures. Dust can be an explosion hazard when exposed to heat or flame. Flammable solid. May burn rapidly with flare burning effect. May re-ignite after fire is extinguished. Dangerous fire hazard in the form of dust when exposed to heat or flame.

Extinguishing Media: Use dry sand, graphite powder, dry sodium chloride-based extinguishers.

Flash Point: Not available.

Autoignition Temperature: Not available.

Explosion Limits, Lower: Not available.

Upper: Not available.

NFPA Rating: (estimated) Health: 4; Flammability: 2; Instability: 1

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks: Vacuum or sweep up material and place into a suitable disposal container. Avoid generating dusty conditions. Remove all sources of ignition. Use a spark-proof tool. Provide ventilation. Place under an inert atmosphere.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Wash hands before eating. Remove contaminated clothing and wash before reuse. Minimize dust generation and accumulation. Use spark-proof tools and explosion proof equipment. Avoid contact with skin and eyes. Do not breathe dust, vapor, mist, or gas. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Keep away from heat, sparks and flame. Do not ingest or inhale. Handle under an inert atmosphere. Store protected from air. Use only in a chemical fume hood. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks or open flames.

Storage: Keep away from heat and flame. Keep away from sources of ignition. Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances. Do not expose to air. Store under an inert atmosphere.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Use explosion-proof ventilation equipment. Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use only under a chemical fume hood. See 29CFR 1910.1027 for regulations applying to all occupational exposures to cadmium and cadmium compounds, in all forms.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Cadmium	0.01 mg/m ³ TWA	9 mg/m ³ IDLH (dust and fume)	0.2 mg/m ³ TWA (dust); 0.1 mg/m ³ TWA (fume); 0.6 mg/m ³ Ceiling (dust); 0.3 mg/m ³ Ceiling (fume); 2.5 æg/m ³ Action Level; 5 æ

OSHA Vacated PELs: Cadmium: No OSHA Vacated PELs are listed for this chemical.

Personal Protective Equipment

Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin: Wear appropriate protective gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

Respirators: A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant a respirator's use.

Section 9 - Physical and Chemical Properties

Physical State: Granules

Appearance: silver white

Odor: odorless

pH: Not available.

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Evaporation Rate: Not applicable.

Viscosity: Not applicable.

Boiling Point: 765 deg C @ 760 mm Hg

Freezing/Melting Point: 321 deg C

Decomposition Temperature: Not available.

Solubility: Insoluble.

Specific Gravity/Density: 8.64 @ 25°C

Molecular Formula: Cd

Molecular Weight: 112.40

Section 10 - Stability and Reactivity

Chemical Stability: Oxidizes when exposed to air. Easily tarnishes in moist air. Powder or liquid is pyrophoric. Contact with acid liberates gas.

Conditions to Avoid: Ignition sources, dust generation, excess heat, prolonged exposure to air.

Incompatibilities with Other Materials: Strong oxidizing agents, acids, sulfur, zinc, selenium, tellurium.

Hazardous Decomposition Products: Toxic cadmium oxide fumes.

Hazardous Polymerization: Has not been reported.

Section 11 - Toxicological Information

RTECS#:

CAS# 7440-43-9: EU9800000

LD50/LC50:

CAS# 7440-43-9:

Inhalation, rat: LC50 = 25 mg/m³/30M;

Oral, mouse: LD50 = 890 mg/kg;

Oral, rat: LD50 = 2330 mg/kg;

Carcinogenicity:

CAS# 7440-43-9:

ACGIH: A2 - Suspected Human Carcinogen

California: carcinogen, initial date 10/1/87

NIOSH: potential occupational carcinogen (dust)

NTP: Known carcinogen

OSHA: Select carcinogen

IARC: Group 1 carcinogen

Epidemiology: Occupational exposure to cadmium has been implicated in a significant increase in prostate and respiratory tract cancer. There is evidence of a significant excess of respiratory cancer deaths among a cohort of cadmium production workers, and concluded that cadmium and its compounds are potential carcinogens.

Teratogenicity: Oral, rat: TDLo = 155 mg/kg (male 13 week(s) pre-mating and female 13 week(s) pre-mating - 3 week(s) after conception) Effects on Newborn - growth statistics (e.g.%, reduced weight gain) and Effects on Newborn - behavioral.; Oral, rat: TDLo = 23 mg/kg (female 1-22 day(s) after conception) Specific Developmental Abnormalities - blood and lymphatic systems (including spleen and marrow).; Oral, mouse: TDLo = 1700 mg/kg (female 8-12 day(s) after conception) Effects on Newborn - viability index (e.g., # alive at day 4 per # born alive) and Effects on Newborn - growth status

Reproductive Effects: Oral, rat: TDLo = 21500 ug/kg (multigenerations) Fertility - pre-implantation mortality (e.g. reduction in number of implants per female; total number of implants per corpora lutea).; Intraperitoneal, rat: TDLo = 1124 ug/kg (male 1 day(s) pre-mating) Paternal Effects - spermatogenesis (incl. genetic material, sperm morphology, motility, and count).

Neurotoxicity: No information available.

Mutagenicity: Micronucleus Test: Mouse, Embryo = 6 umol/L.; Cytogenetic Analysis: Hamster, Ovary = 1 umol/L.

Other Studies: The long-term ingestion of water, beans and rice contaminated with cadmium has

been proposed as the probable cause of crippling condition (itai-itai disease) among Japanese women who have had multiple pregnancies. Characteristics of the disorder are: pain in the back and joints, a waddly gait, osteomalacia, bone fractures, and occasional fatal renal failure.

Section 12 - Ecological Information

Ecotoxicity: Fish: Rainbow trout: TLm = 30 ppm; 24 Hr; Hard water; Fish: Striped bass: LC50 = 0.001 ppm; 24-48 Hr; Static bioassay; Fish: Fathead Minnow: TL50 = 7.2 ppm; 96 Hr; Unspecified Fish: Bluegill/Sunfish: LCO = 0.08 ppm; 96 Hr; Static bioassay (Hard water) No data available.

Environmental: Cadmium can enter the air from natural sources.

Physical: No information available.

Other: No information available.

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

RCRA P-Series: None listed.

RCRA U-Series: None listed.

Section 14 - Transport Information

	US DOT	IATA	RID/ADR	IMO	Canada TDG
Shipping Name:	TOXIC SOLIDS, FLAMMABLE, ORGANIC, N.O.S.				Toxic Solid, Flammable, Organic, N.O.S. (CADMIUM METAL)
Hazard Class:	6.1				6.1
UN Number:	UN2930				UN2930
Packing Group:	I				I

Section 15 - Regulatory Information

US FEDERAL

TSCA

CAS# 7440-43-9 is listed on the TSCA inventory.

Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

Section 12b

None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

SARA**CERCLA Hazardous Substances and corresponding RQs**

CAS# 7440-43-9: 10 lb final RQ (no reporting of releases of this hazardous substance is req

SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

SARA Codes

CAS # 7440-43-9: acute, chronic, flammable.

Section 313

This material contains Cadmium (CAS# 7440-43-9, 100%), which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

Clean Air Act:

This material does not contain any hazardous air pollutants. This material does not contain any Class 1 Ozone depleters. This material does not contain any Class 2 Ozone depleters.

Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA. CAS# 7440-43-9 is listed as a Priority Pollutant under the Clean Water Act. CAS# 7440-43-9 is listed as a Toxic Pollutant under the Clean Water Act.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

CAS# 7440-43-9 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

The following statement(s) is(are) made in order to comply with the California Safe

Drinking Water Act: WARNING: This product contains Cadmium, a chemical known to the state of California to cause cancer. WARNING: This product contains Cadmium, a chemical known to the state of California to cause birth defects or other reproductive harm. California No Significant Risk Level: CAS# 7440-43-9: 0.05 µg/day NSRL (inhalation)

European/International Regulations**European Labeling in Accordance with EC Directives****Hazard Symbols:**

T+ F

Risk Phrases:

R 11 Highly flammable.

R 25 Toxic if swallowed.

R 26 Very toxic by Inhalation.

R 45 May cause cancer.

Safety Phrases:

S 36/37/39 Wear suitable protective clothing, gloves and eye/face protection.

S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

S 53 Avoid exposure - obtain special instructions before use.

WGK (Water Danger/Protection)

CAS# 7440-43-9: No information available.

Canada - DSL/NDSL

CAS# 7440-43-9 is listed on Canada's DSL List.

Canada - WHMIS

This product has a WHMIS classification of D1A, B2.

Canadian Ingredient Disclosure List

CAS# 7440-43-9 is listed on the Canadian Ingredient Disclosure List.

Exposure Limits

CAS# 7440-43-9: OEL-ARAB Republic of Egypt:TWA 0.05 mg/m3 OEL-AUSTRIA:TWA 0.05 mg/m3 OEL-BELGIUM:TWA 0.05 mg/m3 OEL-CZECHOSLOVAKIA:TWA 0.05 mg/m3;STEL 0.1 mg/m3 OEL-DENMARK:TWA 0.01 mg/m3 OEL-FINLAND:TWA 0.02 mg/m3;Carcinogen OEL-GERMANY;Carcinogen OEL-INDIA:TWA 0.05 mg/m3 OEL-JAPAN:TWA 0.05 mg/m3 OEL-THE NETHERLANDS:TWA 0.02 mg/m3;STEL 0.1 mg/m3 OEL-THE PHILIPPINES:TWA 0.2 mg/m3 OEL-RUSSIA:TWA 0.01 mg/m3;STEL 0.05 mg/m3 OEL-SWEDEN:TWA 0.02 mg/m3;Carcinogen OEL-SWITZERLAND:TWA 0.05 mg/m3 OEL-THAILAND:TWA 0.2 mg/m3;STEL 0.5 mg/m3 OEL-TURKEY:TWA 0.2 mg/m3 OEL-UNITED KINGDOM:TWA 0.01 mg/m3 OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA check ACGIH TLV OEL IN NEW ZEALAND, SINGAPORE, VIETNAM check ACGI TLV

Section 16 - Additional Information
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MSDS Creation Date: 6/28/1999

Revision #4 Date: 5/15/2002

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

Material Safety Data Sheet

Chromium

ACC# 05000

Section 1 - Chemical Product and Company Identification

MSDS Name: Chromium**Catalog Numbers:** S79965, S79965-1, S799651, S79965-2, S799652**Synonyms:** Chrome**Company Identification:**

Fisher Scientific

1 Reagent Lane

Fair Lawn, NJ 07410

For information, call: 201-796-7100**Emergency Number:** 201-796-7100**For CHEMTREC assistance, call:** 800-424-9300**For International CHEMTREC assistance, call:** 703-527-3887

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
7440-47-3	CHROMIUM	>=99%	231-157-5

Hazard Symbols: XN**Risk Phrases:** 40

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: silver-gray solid. Causes eye and skin irritation. Causes severe respiratory tract irritation. May cause kidney damage. May cause lung damage. Causes digestive tract irritation. May cause liver damage. May cause allergic skin reaction. **Warning!**

Target Organs: Liver.

Potential Health Effects

Eye: Causes eye irritation. May cause conjunctivitis.**Skin:** Causes skin irritation. Prolonged and/or repeated contact may cause irritation and/or dermatitis. May cause skin sensitization, an allergic reaction, which becomes evident upon re-exposure to this material.**Ingestion:** May cause irritation of the digestive tract. May cause liver damage.**Inhalation:** Causes respiratory tract irritation. Inhalation of fumes may cause metal fume fever, which is characterized by flu-like symptoms with metallic taste, fever, chills, cough, weakness, chest pain, muscle pain and increased white blood cell count. May cause asthma and shortness of breath. May cause headache, coughing, fever, weight loss, and pneumoconiosis.**Chronic:** Prolonged inhalation may cause respiratory tract inflammation and lung damage.

Section 4 - First Aid Measures

Eyes: Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid immediately.

Skin: Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical aid if irritation develops or persists. Wash clothing before reuse.

Ingestion: Do not induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.

Inhalation: Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid. Do NOT use mouth-to-mouth resuscitation.

Notes to Physician: Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information: Evacuate area and fight fire from a safe distance. As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. May burn with invisible flame. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Dust can be an explosion hazard when exposed to heat or flame. Finely divided dusts may exhibit pyrophoric tendencies.

Extinguishing Media: Use dry sand or earth to smother fire. Use dry chemical to fight fire. Contact professional fire-fighters immediately.

Flash Point: Not applicable.

Autoignition Temperature: 752 deg F (400.00 deg C)

Explosion Limits, Lower: .0230oz/ft³

Upper: Not available.

NFPA Rating: (estimated) Health: 2; Flammability: 1; Instability: 1

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks: Clean up spills immediately, observing precautions in the Protective Equipment section. Sweep up or absorb material, then place into a suitable clean, dry, closed container for disposal. Avoid generating dusty conditions. Remove all sources of ignition. Isolate area and deny entry. Place under an inert atmosphere. Do not use combustible materials such as paper towels to clean up spill.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use with adequate ventilation. Minimize dust generation and accumulation. Use spark-proof tools and explosion proof equipment. Avoid contact with skin and eyes. Keep container tightly closed. Keep away from heat, sparks and flame. Avoid ingestion and inhalation. Handle under an inert atmosphere.

Storage: Keep away from heat, sparks, and flame. Store in a tightly closed container. Keep from

contact with oxidizing materials. Store in a cool, dry, well-ventilated area away from incompatible substances. Keep away from acids. Keep containers tightly closed. Do not expose to air. Store under an inert atmosphere.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
CHROMIUM	0.5 mg/m3 TWA	0.5 mg/m3 TWA 250 mg/m3 IDLH	1 mg/m3 TWA

OSHA Vacated PELs: CHROMIUM: 1 mg/m3 TWA

Personal Protective Equipment

Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin: Wear appropriate gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

Respirators: Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

Section 9 - Physical and Chemical Properties

Physical State: Solid

Appearance: silver-gray

Odor: odorless

pH: Not available.

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Evaporation Rate: Not applicable.

Viscosity: Not applicable.

Boiling Point: 4784 deg F

Freezing/Melting Point: 3375 deg F

Decomposition Temperature: Not available.

Solubility: Insoluble in water.

Specific Gravity/Density: 7.2 @28C

Molecular Formula: Cr

Molecular Weight: 51.996

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.

Conditions to Avoid: Incompatible materials, ignition sources, dust generation, exposure to air, acids, strong oxidants.

Incompatibilities with Other Materials: Ammonium nitrate, hydrogen peroxide, lithium, nitric oxide, potassium chlorate, sulfur dioxide, strong oxidizers, hydrochloric acid, sulfuric acid, nitrogen oxide,

Hazardous Decomposition Products: Toxic chromium oxide fumes.

Hazardous Polymerization: Has not been reported.

Section 11 - Toxicological Information

RTECS#:

CAS# 7440-47-3: GB4200000

LD50/LC50:

Not available.

Carcinogenicity:

CAS# 7440-47-3:

IARC: IARC Group 3 - not classifiable

Epidemiology: Certain hexavalent chromium compounds have been demonstrated to be carcinogenic on the basis of epidemiologic investigations on workers and experimental studies in animals. Increased incidences of respiratory cancer have been found in chromium (VI) workers. There is an increased incidence of lung cancer in industrial workers exposed to chromium (VI) compounds. Please refer to IARC volume 23 for a more detailed discussion.

Teratogenicity: No information found.

Reproductive Effects: No information found.

Neurotoxicity: No information found.

Mutagenicity: No information found.

Other Studies: See actual entry in RTECS for complete information.

Section 12 - Ecological Information

No information available.

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

RCRA P-Series: None listed.

RCRA U-Series: None listed.

Section 14 - Transport Information

	US DOT	IATA	RID/ADR	IMO	Canada TDG
Shipping Name:	No information available.				No information available.
Hazard Class:					

UN Number:
Packing Group:

Section 15 - Regulatory Information

US FEDERAL

TSCA

CAS# 7440-47-3 is listed on the TSCA inventory.

Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

Section 12b

None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

SARA

CERCLA Hazardous Substances and corresponding RQs

CAS# 7440-47-3: 5000 lb final RQ (no reporting of releases of this hazardous substance is r

SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

SARA Codes

CAS # 7440-47-3: acute, chronic, flammable.

Section 313

This material contains CHROMIUM (CAS# 7440-47-3, 99%), which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

Clean Air Act:

This material does not contain any hazardous air pollutants. This material does not contain any Class 1 Ozone depleters. This material does not contain any Class 2 Ozone depleters.

Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA. CAS# 7440-47-3 is listed as a Priority Pollutant under the Clean Water Act. CAS# 7440-47-3 is listed as a Toxic Pollutant under the Clean Water Act.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

CAS# 7440-47-3 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California No Significant Risk Level: None of the chemicals in this product are listed.

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:

XN

Risk Phrases:

R 40 Limited evidence of a carcinogenic effect.

Safety Phrases:

WGK (Water Danger/Protection)

CAS# 7440-47-3: No information available.

Canada - DSL/NDSL

CAS# 7440-47-3 is listed on Canada's DSL List.

Canada - WHMIS

This product has a WHMIS classification of D2A, D2B.

Canadian Ingredient Disclosure List

CAS# 7440-47-3 is listed on the Canadian Ingredient Disclosure List.

Exposure Limits

CAS# 7440-47-3: OEL-ARAB Republic of Egypt:TWA 0.05 mg/m3 OEL-AUSTRALIA:TWA 0.05 mg/m3 OEL-BELGIUM:TWA 0.5 mg/m3 OEL-DENMARK:TWA 0.5 mg/m3 OEL-FINLAND:TWA 0.01 mg/m3 OEL-FRANCE:TWA 0.5 mg/m3 OEL-JAPAN:TWA 0.5 mg/m3 OEL-THE NETHERLANDS:TWA 0.5 mg/m3 OEL-THE PHILIPPINES:TWA 1 mg/m3 OEL-SWEDEN:TWA 0.5 mg/m3 OEL-UNITED KINGDOM:TWA 0.5 mg/m3 OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA check ACGIH TLV OEL IN NEW ZEALAND, SINGAPORE, VIETNAM check ACGI TLV

Section 16 - Additional Information
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MSDS Creation Date: 3/01/1999

Revision #5 Date: 3/18/2003

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

Material Safety Data Sheet

Mercury

ACC# 14020

Section 1 - Chemical Product and Company Identification

MSDS Name: Mercury

Catalog Numbers: S71967, S71968, M139-1LB, M139-5LB, M140-14LB, M140-1LB, M140-5LB, M141-1LB, M141-6LB, NC9534278, S40672B, S41542, S41599, S41599B, S41599E, S41599G, S41599J, S41599K, S41599M, S41600P, S41600S, S41600W, S41630A, S41630B, S41630C, S41631, S41631A, S41631B, S41631C, S41645, S45245, S46981, S50443, S71966, S78777

Synonyms: Colloidal mercury; Hydrargyrum; Metallic mercury; Quick silver; Liquid silver

Company Identification:

Fisher Scientific
1 Reagent Lane
Fair Lawn, NJ 07410

For information, call: 201-796-7100

Emergency Number: 201-796-7100

For CHEMTREC assistance, call: 800-424-9300

For International CHEMTREC assistance, call: 703-527-3887

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
7439-97-6	Mercury	ca.100	231-106-7

Hazard Symbols: T N

Risk Phrases: 23 33

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: silver liquid. May cause central nervous system effects. May be absorbed through intact skin. This substance has caused adverse reproductive and fetal effects in animals. Inhalation of fumes may cause metal-fume fever. Harmful if inhaled. Possible sensitizer. May cause liver and kidney damage. **Danger!** Corrosive. May cause severe respiratory tract irritation with possible burns. May cause severe digestive tract irritation with possible burns. Causes eye and skin irritation and possible burns.

Target Organs: Blood, kidneys, central nervous system, liver, brain.

Potential Health Effects

Eye: Exposure to mercury or mercury compounds can cause discoloration on the front surface of the lens, which does not interfere with vision. Causes eye irritation and possible burns. Contact with mercury or mercury compounds can cause ulceration of the conjunctiva and cornea.

Skin: May be absorbed through the skin in harmful amounts. May cause skin sensitization, an allergic reaction, which becomes evident upon re-exposure to this material. Causes skin irritation and possible burns. May cause skin rash (in milder cases), and cold and clammy skin with cyanosis

or pale color.

Ingestion: May cause severe and permanent damage to the digestive tract. May cause perforation of the digestive tract. May cause effects similar to those for inhalation exposure. May cause systemic effects.

Inhalation: Causes chemical burns to the respiratory tract. Inhalation of fumes may cause metal fume fever, which is characterized by flu-like symptoms with metallic taste, fever, chills, cough, weakness, chest pain, muscle pain and increased white blood cell count. May cause central nervous system effects including vertigo, anxiety, depression, muscle incoordination, and emotional instability. Aspiration may lead to pulmonary edema. May cause systemic effects. May cause respiratory sensitization.

Chronic: May cause liver and kidney damage. May cause reproductive and fetal effects. Effects may be delayed. Chronic exposure to mercury may cause permanent central nervous system damage, fatigue, weight loss, tremors, personality changes. Chronic ingestion may cause accumulation of mercury in body tissues. Prolonged or repeated exposure may cause inflammation of the mouth and gums, excessive salivation, and loosening of the teeth.

Section 4 - First Aid Measures

Eyes: Get medical aid immediately. Do NOT allow victim to rub eyes or keep eyes closed. Extensive irrigation with water is required (at least 30 minutes).

Skin: Get medical aid immediately. Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Destroy contaminated shoes.

Ingestion: Do not induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately. Wash mouth out with water.

Inhalation: Get medical aid immediately. Remove from exposure and move to fresh air immediately. If breathing is difficult, give oxygen. Do NOT use mouth-to-mouth resuscitation. If breathing has ceased apply artificial respiration using oxygen and a suitable mechanical device such as a bag and a mask.

Notes to Physician: The concentration of mercury in whole blood is a reasonable measure of the body-burden of mercury and thus is used for monitoring purposes. Treat symptomatically and supportively. Persons with kidney disease, chronic respiratory disease, liver disease, or skin disease may be at increased risk from exposure to this substance.

Antidote: The use of d-Penicillamine as a chelating agent should be determined by qualified medical personnel. The use of Dimercaprol or BAL (British Anti-Lewisite) as a chelating agent should be determined by qualified medical personnel.

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Water runoff can cause environmental damage. Dike and collect water used to fight fire. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

Extinguishing Media: Substance is nonflammable; use agent most appropriate to extinguish surrounding fire. Use water spray, dry chemical, carbon dioxide, or appropriate foam.

Flash Point: Not applicable.

Autoignition Temperature: Not applicable.

Explosion Limits, Lower: Not available.

Upper: Not available.

NFPA Rating: (estimated) Health: 3; Flammability: 0; Instability: 0

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks: Absorb spill with inert material (e.g. vermiculite, sand or earth), then place in suitable container. Avoid runoff into storm sewers and ditches which lead to waterways. Clean up spills immediately, observing precautions in the Protective Equipment section. Provide ventilation.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Minimize dust generation and accumulation. Keep container tightly closed. Do not get on skin or in eyes. Do not ingest or inhale. Use only in a chemical fume hood. Discard contaminated shoes. Do not breathe vapor.

Storage: Keep container closed when not in use. Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances. Keep away from metals. Store protected from azides.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use only under a chemical fume hood.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Mercury	0.025 mg/m ³ TWA; skin - potential for cutaneous absorption	0.05 mg/m ³ TWA (vapor) 10 mg/m ³ IDLH	1 mg/10m ³ Ceiling (vapor)

OSHA Vacated PELs: Mercury: 0.05 mg/m³ TWA (vapor)

Personal Protective Equipment

Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin: Wear appropriate protective gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

Respirators: A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant a respirator's use.

Section 9 - Physical and Chemical Properties

Physical State: Liquid

Appearance: silver

Odor: odorless

pH: Not available.

Vapor Pressure: 0.002 mm Hg @ 25C

Vapor Density: 7.0

Evaporation Rate: Not available.
Viscosity: 15.5 mP @ 25 deg C
Boiling Point: 356.72 deg C
Freezing/Melting Point: -38.87 deg C
Decomposition Temperature: Not available.
Solubility: Insoluble.
Specific Gravity/Density: 13.59 (water=1)
Molecular Formula: Hg
Molecular Weight: 200.59

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.

Conditions to Avoid: High temperatures, incompatible materials.

Incompatibilities with Other Materials: Metals, aluminum, ammonia, chlorates, copper, copper alloys, ethylene oxide, halogens, iron, nitrates, sulfur, sulfuric acid, oxygen, acetylene, lithium, rubidium, sodium carbide, lead, nitromethane, peroxyformic acid, calcium, chlorine dioxide, metal oxides, azides, 3-bromopropyne, alkynes + silver perchlorate, methylsilane + oxygen, tetracarbonylnickel + oxygen, boron diiodophosphide.

Hazardous Decomposition Products: Mercury/mercury oxides.

Hazardous Polymerization: Will not occur.

Section 11 - Toxicological Information

RTECS#:

CAS# 7439-97-6: OV4550000

LD50/LC50:

Not available.

Carcinogenicity:

CAS# 7439-97-6:

IARC: IARC Group 3 - not classifiable

Epidemiology: Intraperitoneal, rat: TDLo = 400 mg/kg/14D-I (Tumorigenic - equivocal tumorigenic agent by RTECS criteria - tumors at site of application).

Teratogenicity: Inhalation, rat: TCLo = 1 mg/m³/24H (female 1-20 day(s) after conception) Effects on Embryo or Fetus - fetotoxicity (except death, e.g., stunted fetus).

Reproductive Effects: Inhalation, rat: TCLo = 890 ng/m³/24H (male 16 week(s) pre-mating) Paternal Effects - spermatogenesis (incl. genetic material, sperm morphology, motility, and count).; Inhalation, rat: TCLo = 7440 ng/m³/24H (male 16 week(s) pre-mating) Fertility - post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants).

Neurotoxicity: The brain is the critical organ in humans for chronic vapor exposure; in severe cases, spontaneous degeneration of the brain cortex can occur as a late sequela to past exposure.

Mutagenicity: Cytogenetic Analysis: Unreported, man = 150 ug/m³.

Other Studies: No information available.

Section 12 - Ecological Information

Ecotoxicity: Fish: Rainbow trout: LC50 = 0.16-0.90 mg/L; 96 Hr; Unspecified Fish: Bluegill/Sunfish: LC50 = 0.16-0.90 mg/L; 96 Hr; Unspecified Fish: Channel catfish: LC50 = 0.35 mg/L; 96 Hr; Unspecified Water flea Daphnia: EC50 = 0.01 mg/L; 48 Hr; Unspecified In aquatic systems, mercury appears to bind to dissolved matter or fine particulates, while the transport of mercury bound to dust particles in the atmosphere or bed sediment particles in rivers and lakes is generally less substantial. The conversion, in aquatic environments, of inorganic mercury compd to methyl mercury implies that recycling of mercury from sediment to water to air and back could be a rapid process.

Environmental: Mercury bioaccumulates and concentrates in food chain (concentration may be as much as 10,000 times that of water). Bioconcentration factors of 63,000 for freshwater fish and 10,000 for salt water fish have been found. Much of the mercury deposited on land, appears to revaporize within a day or two, at least in areas substantially heated by sunlight.

Physical: All forms of mercury (Hg) (metal, vapor, inorganic, or organic) are converted to methyl mercury. Inorganic forms are converted by microbial action in the atmosphere to methyl mercury.

Other: No information available.

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

RCRA P-Series: None listed.

RCRA U-Series: CAS# 7439-97-6: waste number U151.

Section 14 - Transport Information

	US DOT	IATA	RID/ADR	IMO	Canada TDG
Shipping Name:	MERCURY				MERCURY
Hazard Class:	8				8
UN Number:	UN2809				UN2809
Packing Group:	III				III

Section 15 - Regulatory Information

US FEDERAL

TSCA

CAS# 7439-97-6 is listed on the TSCA inventory.

Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

Section 12b

None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

SARA

CERCLA Hazardous Substances and corresponding RQs

CAS# 7439-97-6: 1 lb final RQ; 0.454 kg final-RQ

SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

SARA Codes

CAS # 7439-97-6: acute, chronic.

Section 313

This chemical is not at a high enough concentration to be reportable under Section 313. No chemicals are reportable under Section 313.

Clean Air Act:

This material does not contain any hazardous air pollutants. This material does not contain any Class 1 Ozone depleters. This material does not contain any Class 2 Ozone depleters.

Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA. CAS# 7439-97-6 is listed as a Priority Pollutant under the Clean Water Act. CAS# 7439-97-6 is listed as a Toxic Pollutant under the Clean Water Act.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

CAS# 7439-97-6 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

WARNING: This product contains Mercury, a chemical known to the state of California to cause birth defects or other reproductive harm. California No Significant Risk Level: None of the chemicals in this product are listed.

European/International Regulations**European Labeling in Accordance with EC Directives****Hazard Symbols:**

T N

Risk Phrases:

R 23 Toxic by inhalation.

R 33 Danger of cumulative effects.

R 50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Safety Phrases:

S 1/2 Keep locked up and out of reach of children.
S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

S 7 Keep container tightly closed.

S 60 This material and its container must be disposed of as hazardous waste.

S 61 Avoid release to the environment. Refer to special instructions/safety data sheets.

WGK (Water Danger/Protection)

CAS# 7439-97-6: 3

Canada - DSL/NDSL

CAS# 7439-97-6 is listed on Canada's DSL List.

Canada - WHMIS

This product has a WHMIS classification of D2A, E.

Canadian Ingredient Disclosure List

CAS# 7439-97-6 is listed on the Canadian Ingredient Disclosure List.

Exposure Limits

CAS# 7439-97-6: OEL-ARAB Republic of Egypt:TWA 0.05 mg/m3 OEL-AUSTRIA:TWA 0.1 mg/m3;Skin OEL-BELGIUM:TWA 0.1 mg/m3;Skin OEL-FINLAND:TWA 0.05 mg/m3 OEL-FRANCE:TWA 0.05 mg/m3;Skin (vapor) OEL-FRANCE:TWA 0.1 mg/m3;Skin OEL-HUNGARY:TWA 0.02 mg/m3;STEL 0.04 mg/m3 OEL-POLAND:TWA 0.05 mg/m3 OEL-SWEDEN:TWA 0.05 mg/m3 (vapor) OEL-SWITZERLAND:TWA 0.005 ppm (0.05 mg/m3);Skin (vapor) OEL-SWITZERLAND:TWA 0.01 mg/m3;Skin OEL-TURKEY:TWA 0.1 mg/m3;Skin OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA check ACGIH TLV OEL IN NEW ZEALAND, SINGAPORE, VIETNAM check ACGI TLV OEL-AUSTRALIA:TWA 0.05 mg(Hg)/m3;Skin JANUARY 1993 OEL-BELGIUM:TWA 0.05 mg(Hg)/m3;Skin JANUARY 1993 OEL-CZECHOSLOVAKIA:TWA 0.05 mg(Hg)/m3;STEL 0.15 mg(Hg)/m3 OEL-DENMARK:TWA 0.05 mg(Hg)/m3 JANUARY 1993 OEL-FINLAND:TWA 0.05 mg(Hg)/m3 JANUARY 1993 OEL-FRANCE:TWA 0.05 mg(Hg)/m3 JANUARY 1993 OEL-GERMANY:TWA 0.01 ppm (0.1 mg(Hg)/m3) JANUARY 1993 OEL-HUNGARY:TWA 0.02 mg(Hg)/m3;STEL 0.04 mg(Hg)/m JANUARY 1993 OEL-JAPAN:TWA 0.05 mg(Hg)/m3 JANUARY 1993 OEL-THE NETHERLANDS:TWA 0.05 mg(Hg)/m3;STEL 0.15 mg(Hg)/m3 OEL-THE PHILIPPINES:TWA 0.05 mg(Hg)/m3 JANUARY 1993 OEL-POLAND:TWA 0.01 mg(Hg)/m3 JANUARY 1993 OEL-RUSSIA:TWA 0.05 mg(Hg)

Section 16 - Additional Information

MSDS Creation Date: 6/15/1999

Revision #6 Date: 2/05/2004

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

MSDS Number: L2350 * * * * * Effective Date: 08/10/04 * * * * * Supersedes: 11/02/01

MSDS**Material Safety Data Sheet**

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865



24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. And Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

LEAD ATOMIC ABSORPTION STANDARD

1. Product Identification

Synonyms: Lead AA Standard; Lead Atomic Absorption Standard (1000 ppm); Lead, DILUT-IT® Analytical Conc., Std, 1g Pb2+
CAS No.: Not applicable to mixtures.
Molecular Weight: Not applicable to mixtures.
Chemical Formula: Not applicable. (ca. 99% water)
Product Codes: 4779

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Nitric Acid	7697-37-2	1 - 3%	Yes
Lead Nitrate	10099-74-8	1 - 4%	Yes
Water	7732-18-5	93 - 99%	No

3. Hazards Identification

Emergency Overview

DANGER! CORROSIVE! LIQUID AND MIST CAUSE SEVERE BURNS TO EVERY AREA OF CONTACT. VAPOR IRRITATING TO EYES AND RESPIRATORY TRACT. HARMFUL IF SWALLOWED OR INHALED. MAY AFFECT THE GUM TISSUE, CENTRAL NERVOUS SYSTEM, KIDNEYS, BLOOD, REPRODUCTIVE SYSTEM, AND RESPIRATORY TRACT (Lead component). INHALATION MAY CAUSE LUNG AND TOOTH DAMAGE.

J.T. Baker SAF-T-DATA^(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Life)

Flammability Rating: 0 - None

Reactivity Rating: 1 - Slight

Contact Rating: 3 - Severe (Corrosive)

Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES

Storage Color Code: White (Corrosive)

Potential Health Effects

Nitric acid is extremely hazardous; it is corrosive, reactive, an oxidizer, and a poison. The following hazards are for concentrated solutions. Hazards of less concentrated solutions may be reduced. Degree of hazard for reduced concentrations is not currently addressed in the available literature.

Inhalation:

Corrosive. Effects should be less severe than from exposure to higher concentrations where symptoms may include irritation of the nose and throat, labored breathing, as well as lung edema, damage to the mucous membranes and upper respiratory tract.

Ingestion:

Corrosive. Effects should be less severe than from exposure to higher concentrations where symptoms may include severe burns of the mouth, throat, and stomach. May cause sore throat, vomiting, diarrhea. Symptoms from nitric acid exposure may include burning sensation, vomiting and diarrhea. The symptoms of lead poisoning include abdominal pain and spasms, nausea, vomiting, headache. Acute poisoning can lead to muscle weakness, "lead line" on the gums, metallic taste, definite loss of appetite, insomnia, dizziness, high lead levels in blood and urine with shock, coma and death in extreme cases.

Skin Contact:

Corrosive. Effects should be less severe than from exposure to higher concentrations where symptoms may include redness, pain, and burns to the skin.

Eye Contact:

Corrosive. Effects should be less severe than from exposure to higher concentrations where symptoms may include blurred vision, redness, pain, and burns to eye tissue and possible permanent eye damage.

Chronic Exposure:

Lead is a cumulative poison and exposure even to small amounts can raise the body's content to toxic levels. The symptoms of chronic exposure are like those of ingestion poisoning; restlessness, irritability, visual disturbances, hypertension and gray facial color may also be noted. Long-term exposure to concentrated vapors may cause erosion of teeth

and lung damage. Long-term exposures seldom occur due to the corrosive properties of the acid.

Aggravation of Pre-existing Conditions:

Persons with pre-existing skin disorders, eye disease, or cardiopulmonary diseases may be more susceptible to the effects of this substance.

4. First Aid Measures

Immediate first aid treatment reduces the health effects of this substance.

Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Ingestion:

If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Skin Contact:

Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention immediately. Wash clothing before reuse. Thoroughly clean shoes before reuse.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:

Not combustible, but concentrated material is a strong oxidizer and its heat of reaction with reducing agents or combustibles may cause ignition.

Explosion:

Concentrated material reacts explosively with combustible organic or readily oxidizable materials such as: alcohols, turpentine, charcoal, organic refuse, metal powder, hydrogen sulfide, etc. Reacts with most metals to release hydrogen gas which can form explosive mixtures with air.

Fire Extinguishing Media:

Use any means suitable for extinguishing surrounding fire.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Neutralize spill with sodium bicarbonate or soda ash. Do not over neutralize. Ventilate area

of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Contain and recover liquid when possible. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer!

J. T. Baker NEUTRASORB® or TEAM® 'Low Na+' acid neutralizers are recommended for spills of this product.

7. Handling and Storage

Store in a cool, dry, ventilated storage area with acid resistant floors and good drainage. Protect from physical damage. Keep out of direct sunlight and away from heat, water, and incompatible materials. Do not wash out container and use it for other purposes. When diluting, the acid should always be added slowly to water and in small amounts. Never use hot water and never add water to the acid. Water added to acid can cause uncontrolled boiling and splashing. Protect from freezing. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

- OSHA Permissible Exposure Limit (PEL) -

Nitric Acid: 2 ppm (TWA),

Lead: 0.05 mg/m³ (TWA), 0.03 mg/m³ (Action Level).

- ACGIH Threshold Limit Value (TLV) -

Nitric Acid: 2 ppm (TWA), 4 ppm (STEL),

Lead: 0.05 mg/m³ (TWA), A3 - Animal carcinogen.

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

Not expected to require personal respirator usage. If the exposure limit is exceeded and engineering controls are not feasible, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus. Breathing air quality must meet the requirements of the OSHA respiratory protection standard (29CFR1910.134).

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain

eye wash fountain and quick-drench facilities in work area.

Other Control Measures:

Eating, drinking, and smoking should not be permitted in areas where solids or liquids containing lead compounds are handled, processed, or stored. See OSHA substance-specific standard for more information on personal protective equipment, engineering and work practice controls, medical surveillance, record keeping, and reporting requirements. (29 CFR 1910.1025).

9. Physical and Chemical Properties

Appearance:

Clear, colorless solution.

Odor:

Odorless.

Solubility:

Infinitely soluble.

Specific Gravity:

ca. 1.0

pH:

No information found.

% Volatiles by volume @ 21C (70F):

ca. 95

Boiling Point:

ca. 100C (ca. 212F)

Melting Point:

ca. 0C (ca. 32F)

Vapor Density (Air=1):

Essentially the same as water.

Vapor Pressure (mm Hg):

Essentially the same as water.

Evaporation Rate (BuAc=1):

Essentially the same as water.

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage.

Hazardous Decomposition Products:

Toxic metal fumes may form when heated to decomposition.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

A dangerously powerful oxidizing agent, concentrated nitric acid is incompatible with most substances, especially strong bases, metallic powders, carbides, hydrogen sulfide, turpentine, and combustible organics.

Conditions to Avoid:

Incompatibles.

11. Toxicological Information

Toxicological Data:

Nitric Acid: investigated as a mutagen, reproductive effector.

Lead Nitrate: investigated as a tumorigen, mutagen and reproductive effector.

Reproductive Toxicity:

Lead and other smelter emissions are human reproductive hazards. (Chemical Council on Environmental Quality; Chemical Hazards to Human Reproduction, 1981).

Carcinogenicity:

For lead and inorganic lead compounds:

EPA / IRIS classification: Group B2 - Probable human carcinogen, sufficient animal evidence.

-----\Cancer Lists\-----			
Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Nitric Acid (7697-37-2)	No	No	None
Lead Nitrate (10099-74-8)	No	No	2B
Water (7732-18-5)	No	No	None

12. Ecological Information

Environmental Fate:

No information found.

Environmental Toxicity:

No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Not regulated.

15. Regulatory Information

-----\Chemical Inventory Status - Part 1\-----				
Ingredient	TSCA	EC	Japan	Australia
Nitric Acid (7697-37-2)	Yes	Yes	Yes	Yes
Lead Nitrate (10099-74-8)	Yes	Yes	Yes	Yes
Water (7732-18-5)	Yes	Yes	Yes	Yes

-----\Chemical Inventory Status - Part 2\-----				
Ingredient	Korea	--Canada--		Phil.
		DSL	NDSL	
Nitric Acid (7697-37-2)	Yes	Yes	No	Yes
Lead Nitrate (10099-74-8)	Yes	Yes	No	No
Water (7732-18-5)	Yes	Yes	No	Yes

-----\Federal, State & International Regulations - Part 1\-----				
Ingredient	-SARA 302-		-----SARA 313-----	
	RQ	TPQ	List	Chemical Catg.
Nitric Acid (7697-37-2)	1000	1000	Yes	No
Lead Nitrate (10099-74-8)	No	No	No	Lead compd/ni
Water (7732-18-5)	No	No	No	No

-----\Federal, State & International Regulations - Part 2\-----			
Ingredient	CERCLA	-RCRA-	-TSCA-
		261.33	8(d)
Nitric Acid (7697-37-2)	1000	No	No
Lead Nitrate (10099-74-8)	10	No	No
Water (7732-18-5)	No	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
 SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
 Reactivity: No (Mixture / Liquid)

WARNING:

THIS PRODUCT CONTAINS CHEMICALS KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER AND BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM.

Australian Hazchem Code: 2R

Poison Schedule: None allocated.

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: 2 Flammability: 0 Reactivity: 0

Label Hazard Warning:

DANGER! CORROSIVE! LIQUID AND MIST CAUSE SEVERE BURNS TO EVERY AREA OF CONTACT. VAPOR IRRITATING TO EYES AND RESPIRATORY TRACT. HARMFUL IF SWALLOWED OR INHALED. MAY AFFECT THE GUM TISSUE, CENTRAL NERVOUS SYSTEM, KIDNEYS, BLOOD, REPRODUCTIVE SYSTEM, AND RESPIRATORY TRACT (Lead component). INHALATION MAY CAUSE LUNG AND TOOTH DAMAGE.

Label Precautions:

Do not get in eyes, on skin, or on clothing.

Do not breathe vapor or mist.

Keep container closed.

Use only with adequate ventilation.

Wash thoroughly after handling.

Label First Aid:

In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In all cases get medical attention immediately.

Product Use:

Laboratory Reagent.

Revision Information:

No Changes.

Disclaimer:

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Prepared by: Environmental Health & Safety

Phone Number: (314) 654-1600 (U.S.A.)

Material Safety Data Sheet

Silver

ACC# 20770

Section 1 - Chemical Product and Company Identification

MSDS Name: Silver**Catalog Numbers:** S80162, S163 10, S163-10, S16310, ZZS166C17**Synonyms:** Argentum.**Company Identification:**

Fisher Scientific

1 Reagent Lane

Fair Lawn, NJ 07410

For information, call: 201-796-7100**Emergency Number:** 201-796-7100**For CHEMTREC assistance, call:** 800-424-9300**For International CHEMTREC assistance, call:** 703-527-3887

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
7440-22-4	Silver	100	231-131-3

Hazard Symbols: None listed.**Risk Phrases:** 33

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: white solid. **Caution!** May cause respiratory and digestive tract irritation. May cause eye and skin irritation. Danger of cumulative effects.

Target Organs: Kidneys.

Potential Health Effects

Eye: May cause eye irritation.

Skin: May cause skin irritation. May cause skin discoloration.

Ingestion: May cause irritation of the digestive tract. Effects may be cumulative. Ingestion of silver compounds may cause abdominal pain, rigidity, convulsions and shock.

Inhalation: May cause respiratory tract irritation. Inhalation of fumes may cause metal fume fever, which is characterized by flu-like symptoms with metallic taste, fever, chills, cough, weakness, chest pain, muscle pain and increased white blood cell count.

Chronic: Chronic inhalation or ingestion of silver salts may cause argyria characterized by a permanent blue-gray discoloration of the eyes, skin, mucous membranes, and internal organs. This malady results from the accumulation of silver in the body.

Section 4 - First Aid Measures

Eyes: Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. If irritation develops, get medical aid.

Skin: Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical aid if irritation develops or persists. Wash clothing before reuse.

Ingestion: Do NOT induce vomiting. If conscious and alert, rinse mouth and drink 2-4 cupfuls of milk or water. Wash mouth out with water. Get medical aid if irritation or symptoms occur.

Inhalation: Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid if cough or other symptoms appear.

Notes to Physician: Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Non-combustible, substance itself does not burn but may decompose upon heating to produce corrosive and/or toxic fumes.

Extinguishing Media: Substance is noncombustible; use agent most appropriate to extinguish surrounding fire. Use water spray, dry chemical, carbon dioxide, or appropriate foam.

Flash Point: Not applicable.

Autoignition Temperature: Not applicable.

Explosion Limits, Lower: Not available.

Upper: Not available.

NFPA Rating: (estimated) Health: 1; Flammability: 0; Instability: 0

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks: Vacuum or sweep up material and place into a suitable disposal container. Clean up spills immediately, observing precautions in the Protective Equipment section. Avoid generating dusty conditions. Provide ventilation.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Wash hands before eating. Avoid contact with eyes, skin, and clothing. Keep container tightly closed. Avoid ingestion and inhalation. Use with adequate ventilation.

Storage: Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances. No special precautions indicated.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate ventilation to keep airborne concentrations low.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Silver	0.1 mg/m ³ TWA	0.01 mg/m ³ TWA (dust) 10 mg/m ³ IDLH (dust)	0.01 mg/m ³ TWA

OSHA Vacated PELs: Silver: 0.01 mg/m³ TWA

Personal Protective Equipment

Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin: Wear appropriate protective gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to minimize contact with skin.

Respirators: A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant a respirator's use.

Section 9 - Physical and Chemical Properties

Physical State: Solid

Appearance: white

Odor: none reported

pH: Not available.

Vapor Pressure: 100 mm Hg @ 1865 C

Vapor Density: Not available.

Evaporation Rate: Not applicable.

Viscosity: Not available.

Boiling Point: 2212 deg C

Freezing/Melting Point: 961 deg C

Decomposition Temperature: Not available.

Solubility: Insoluble in water.

Specific Gravity/Density: 10.5

Molecular Formula: Ag

Molecular Weight: 107.8682

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.

Conditions to Avoid: Incompatible materials, exposure to air.

Incompatibilities with Other Materials: Strong acids, strong bases, ethyleneimine.

Hazardous Decomposition Products: Irritating and toxic fumes and gases, silver fumes.

Hazardous Polymerization: Has not been reported.

Section 11 - Toxicological Information

RTECS#:**CAS#** 7440-22-4: VW3500000**LD50/LC50:**

Not available.

Carcinogenicity:

CAS# 7440-22-4: Not listed by ACGIH, IARC, NIOSH, NTP, or OSHA.

Epidemiology: No data available.**Teratogenicity:** No data available.**Reproductive Effects:** No data available.**Neurotoxicity:** No data available.**Mutagenicity:** No data available.**Other Studies:** See actual entry in RTECS for complete information.

Section 12 - Ecological Information

Ecotoxicity: No data available. No information available.**Environmental:** Aquatic Fate: Sorption and precipitation processes are effective in reducing the concn of dissolved silver and result in higher concn in the bed sediments than in the overlying waters. Sorption by manganese dioxide and precipitation with halides are probably the dominant controls on the mobility of silver in the aquatic environment.**Physical:** Algae, daphnia, fresh water mussels, and fathead minnows were all found capable of accumulating silver; but the food chain was not an important route of silver accumulation for animals at higher trophic levels, suggesting no food chain magnification.**Other:** For more information, see "HANDBOOK OF ENVIRONMENTAL FATE AND EXPOSURE DATA."

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

RCRA P-Series: None listed.**RCRA U-Series:** None listed.

Section 14 - Transport Information

	US DOT	IATA	RID/ADR	IMO	Canada TDG
Shipping Name:	No information available.				No information available.
Hazard Class:					
UN Number:					
Packing Group:					

Section 15 - Regulatory Information

US FEDERAL

TSCA

CAS# 7440-22-4 is listed on the TSCA inventory.

Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

Section 12b

None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

SARA

CERCLA Hazardous Substances and corresponding RQs

CAS# 7440-22-4: 1000 lb final RQ (no reporting of releases of this hazardous substance is r

SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

SARA Codes

CAS # 7440-22-4: chronic, flammable.

Section 313

This material contains Silver (CAS# 7440-22-4, 100%), which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

Clean Air Act:

This material does not contain any hazardous air pollutants. This material does not contain any Class 1 Ozone depleters. This material does not contain any Class 2 Ozone depleters.

Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA. CAS# 7440-22-4 is listed as a Priority Pollutant under the Clean Water Act. CAS# 7440-22-4 is listed as a Toxic Pollutant under the Clean Water Act.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

CAS# 7440-22-4 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California No Significant Risk Level: None of the chemicals in this product are listed.

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:

Not available.

Risk Phrases:

R 33 Danger of cumulative effects.

Safety Phrases:

S 37 Wear suitable gloves.

S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

S 28A After contact with skin, wash immediately with plenty of water.

WGK (Water Danger/Protection)

CAS# 7440-22-4: 0

Canada - DSL/NDSL

CAS# 7440-22-4 is listed on Canada's DSL List.

Canada - WHMIS

This product has a WHMIS classification of D2A.

Canadian Ingredient Disclosure List

CAS# 7440-22-4 is listed on the Canadian Ingredient Disclosure List.

Exposure Limits

CAS# 7440-22-4: OEL-AUSTRALIA:TWA 0.1 mg/m3 OEL-BELGIUM:TWA 0.1 mg/m3 OEL-DENMARK:TWA 0.01 mg/m3 OEL-FINLAND:TWA 0.1 mg/m3 OEL-FRANCE:TWA 0.1 mg/m3 OEL-GERMANY:TWA 0.01 mg/m3 OEL-RUSSIA:STEL 1 mg/m3 OEL-SWITZERLAND:TWA 0.01 mg/m3 OEL-UNITED KINGDOM:TWA 0.1 mg/m3 OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA check ACGIH TLV OEL IN NEW ZEALAND, SINGAPORE, VIETNAM check ACGI TLV

Section 16 - Additional Information
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MSDS Creation Date: 12/12/1997**Revision #6 Date:** 3/18/2003

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

MSDS Number: S1106 * * * * * Effective Date: 05/08/03 * * * * * Supersedes: 08/02/00



Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865



24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. And Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2637) for assistance.

Selenium

1. Product Identification

Synonyms: Elemental Selenium; Selen; C.I. 77805
CAS No.: 7782-49-2
Molecular Weight: 78.96
Chemical Formula: Se
Product Codes: 3395

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Selenium	7782-49-2	90 - 100%	Yes

3. Hazards Identification

Emergency Overview

WARNING! CAUSES SEVERE IRRITATION TO EYES, SKIN AND RESPIRATORY TRACT. HARMFUL IF SWALLOWED OR INHALED. AFFECTS

LIVER, KIDNEYS, BLOOD, SPLEEN.

J.T. Baker SAF-T-DATA^(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Life)

Flammability Rating: 0 - None

Reactivity Rating: 1 - Slight

Contact Rating: 2 - Moderate

Lab Protective Equip: GOGGLES; LAB COAT; PROPER GLOVES

Storage Color Code: Blue (Health)

Potential Health Effects

Inhalation:

Severe irritant to the respiratory system. Soreness, coughing, labored breathing are symptoms which may subside and return. Lung edema may occur in acute cases. Cases with flu-like symptoms resembling metal fume fever within 24 hours of exposure have been reported.

Ingestion:

May cause severe irritation to the mouth and throat. Gastrointestinal disturbances may be expected with nausea, abdominal pain, and vomiting.

Skin Contact:

Causes severe irritation. Symptoms include redness, itching and pain.

Eye Contact:

May cause severe irritation, redness, pain.

Chronic Exposure:

Chronic exposure may cause odor of garlic on breath, fatigue, irritability, respiratory tract irritation, gastrointestinal irritation, metallic taste, and allergic eye reaction. Based on animal studies, may cause blood, liver, kidney and spleen effects.

Aggravation of Pre-existing Conditions:

Person with a history of asthma, allergies, or known sensitization to selenium, or with a history of other chronic respiratory disease, gastrointestinal disturbances, disorders of the liver or kidneys, or recurrent dermatitis would be expected to be at increased risk from exposure.

4. First Aid Measures

Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Ingestion:

Do NOT induce vomiting. Give large amounts of water. Never give anything by mouth to an unconscious person. Get medical attention.

Skin Contact:

Immediately flush skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean

shoes before reuse.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:

Not considered to be a fire hazard.

Explosion:

Not considered to be an explosion hazard.

Fire Extinguishing Media:

Use any means suitable for extinguishing surrounding fire.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Ventilate area of leak or spill. Keep unnecessary and unprotected people away from area of spill. Wear appropriate personal protective equipment as specified in Section 8. Spills: Pick up and place in a suitable container for reclamation or disposal, using a method that does not generate dust. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Isolate from incompatible substances. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

-OSHA Permissible Exposure Limit (PEL):

0.2 mg/m³, Selenium Compounds, as Se

-ACGIH Threshold Limit Value (TLV):

0.2 mg/m³, Selenium & Compounds, as Se

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded, a half-face dust/mist respirator may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece dust/mist respirator may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency, or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. **WARNING:** Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or full face shield where dusting or splashing of solutions is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:

Small blue-black metallic shot.

Odor:

Odorless.

Solubility:

Insoluble in water.

Specific Gravity:

4.26-4.81

pH:

No information found.

% Volatiles by volume @ 21C (70F):

0

Boiling Point:

690C (1274F)

Melting Point:

170 - 217C (338 - 423F)

Vapor Density (Air=1):

Not applicable.

Vapor Pressure (mm Hg):

Not applicable.

Evaporation Rate (BuAc=1):

Not applicable.

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage.

Hazardous Decomposition Products:

Toxic oxides of selenium form when heated to decomposition.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

Strong oxidizers, strong acids, and a wide range of other materials.

Conditions to Avoid:

Moisture and incompatibles.

11. Toxicological Information

Toxicological Data:

Oral Rat LD50: 6700 mg/kg. Investigated as a tumorigen and a reproductive effector.

Carcinogenicity:

EPA / IRIS classification: Group D1 - Not classifiable as a human carcinogen.

-----\Cancer Lists\-----			
Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Selenium (7782-49-2)	No	No	3

12. Ecological Information

Environmental Fate:

No information found.

Environmental Toxicity:

No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in

accordance with federal, state and local requirements.

14. Transport Information

Not regulated.

15. Regulatory Information

-----\Chemical Inventory Status - Part 1\-----
Ingredient TSCA EC Japan Australia

Selenium (7782-49-2) Yes Yes No Yes

-----\Chemical Inventory Status - Part 2\-----
Ingredient Korea DSL --Canada-- NDSL Phil.

Selenium (7782-49-2) Yes Yes No Yes

-----\Federal, State & International Regulations - Part 1\-----
Ingredient -SARA 302- -SARA 313-
RQ TPQ List Chemical Catg.

Selenium (7782-49-2) No No No Selenium cmp

-----\Federal, State & International Regulations - Part 2\-----
Ingredient CERCLA -RCRA- -TSCA-
261.33 8(d)

Selenium (7782-49-2) 100 No No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
Reactivity: No (Pure / Solid)

Australian Hazchem Code: 2Z

Poison Schedule: None allocated.

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: 2 Flammability: 0 Reactivity: 0

Label Hazard Warning:

WARNING! CAUSES SEVERE IRRITATION TO EYES, SKIN AND RESPIRATORY TRACT. HARMFUL IF SWALLOWED OR INHALED. AFFECTS LIVER, KIDNEYS, BLOOD, SPLEEN.

Label Precautions:

Avoid contact with eyes, skin and clothing.

Wash thoroughly after handling.

Avoid breathing dust.

Do not breathe mist.

Use only with adequate ventilation.

Label First Aid:

If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases, get medical attention.

Product Use:

Laboratory Reagent.

Revision Information:

No Changes.

Disclaimer:

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Prepared by: Environmental Health & Safety

Phone Number: (314) 654-1600 (U.S.A.)

APPENDIX C

List of Approved Amendments/changes

HASP Acknowledgement/Agreement Form

Visitors Log

Tailgate Safety Meeting Form

Air Quality Monitoring Record

Equipment Calibration Log

Checklist for Subsurface Investigation

Monthly Heavy Equipment Safety Inspection Checklist

Voluntary Respirator Use Form

HEALTH AND SAFETY PLAN (HASP)

List of Approved Amendments/Changes

[illegible]

[illegible]

(All ATC, Subcontractor & Client Personnel Must Sign)

Client Site Name: _____
Project Site No. _____

I acknowledge I have reviewed a copy of the Health and Safety Plan for this project, understand it, and agree to comply with all of its provisions. I also understand I could be prohibited by the Site Health and Safety Coordinator or other ATC personnel from working on this project for not complying with any aspect of this Health and Safety Plan:

[illegible]

HEALTH AND SAFETY PLAN (HASP)

Visitors Log

Client Site Name: _____

Project Site No. _____

[illegible]

HEALTH AND SAFETY PLAN (HASP) Tailgate Safety Meeting Form

Site Name & Number: _____

ATC Project No: _____

Work Being Performed: _____

Date & Time of Meeting: _____

Name of Presenter: _____

NOTE: On the initial day of the project, the Project Manager or designee should conduct a visual inspection of the project site (using the Site Safety Checklist) prior to the Tailgate Safety Meeting. This inspection should include a review of project site equipment, hazards, and specific job tasks, activities or operations to be performed for that day. These specific items must be covered during the Tailgate Safety Meeting. For subsequent days, any changes to the site or operations must be covered in the Tailgate Safety Meeting. In addition, "Task-Specific" Job Safety Analysis (JSA) for the tasks/activities at the project site must be integrated into the HASP and Tailgate discussions.

Itemize the Specific Topics Discussed (if more space is needed use the back of this page):

☐ Are all employees okay? ☐ Are all employees physically able to perform their job duties? ☐ "Shared Learning" items?

☐ Has PPE been checked? ☐ Emergency evacuation area identified? ☐ Asked for Sub interactions or questions?

☐ **Client Requirements** - By checking the box to the left, the Presenter of the Tailgate Meeting acknowledges that all Client-specific requirements have been completed for both ATC and Subcontractor employees.

Participants (if needed, list additional participants on back of this page):

Print Name	Signature	Company	Date

A Tailgate Safety Meeting must be conducted and documented at the beginning of each workday when two or more ATC employees and/or Subcontractor representatives are present on site. Employees, client representatives and subcontractors who arrive at the site after the Tailgate Safety Meeting has been conducted must be briefed on the topics and acknowledge by signing this form. The JSA must be completed at the beginning of each day when one or more ATC employees and/or subcontractor representatives are present on a site.

**Appendix 07-05
Tailgate Safety Meeting Form**

Site Name & Number: _____

ATC Project Number: _____

Work Being Performed: _____

Date & Time of Meeting: _____

Name of Presenter: _____

NOTE: On the initial day of the project, the Project Manager or designee should conduct a visual inspection of the project site prior to the Tailgate Safety Meeting. This inspection should include a review of project site equipment, hazards, and specific job tasks, activities or operations to be performed for that day. These specific items must be covered during the Tailgate Safety Meeting. For subsequent days, any changes to the site or operations must be covered in the Tailgate Safety Meeting. In addition, “Task-Specific” Job Safety Analysis (JSA) for the tasks/activities at the project site must be integrated into the HASP and Tailgate discussions.

Itemize the Specific Topics Discussed (if more space is needed use the back of this page):

- | | | |
|--|---|---|
| <input type="checkbox"/> Are all employees okay? | <input type="checkbox"/> Are all employees physically able to perform their job duties? | <input type="checkbox"/> “Shared Learning” items? |
| <input type="checkbox"/> Has PPE been checked? | <input type="checkbox"/> Emergency evacuation area identified? | <input type="checkbox"/> Asked for Sub interactions or questions? |

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ATC Project Number: _____

Work Being Performed: _____

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ATC Project Number: _____

Work Being Performed: _____

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Tailgate Safety Meeting Form**

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ATC Project Number: _____

Work Being Performed: _____

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| <input type="checkbox"/> Has PPE been checked? | <input type="checkbox"/> Emergency evacuation area identified? | <input type="checkbox"/> Asked for Sub interactions or questions? |

- ☐ **Client Requirements** - By checking the box to the left, the Presenter of the Tailgate Meeting acknowledges that all Client-specific requirements have been completed for both ATC and Subcontractor employees.

Participants (if needed, list additional participants on back of this page):

Print Name	Signature	Company	Date

A Tailgate Safety Meeting must be conducted and documented at the beginning of each workday when two or more ATC employees and/or Subcontractor representatives are present on site. Employees, client representatives and subcontractors who arrive at the site after the Tailgate Safety Meeting has been conducted must be briefed on the topics and acknowledge by signing this form. The JSA must be completed at the beginning of each day when one or more ATC employees and/or subcontractor representatives are present on a site.

**Appendix 07-05
Tailgate Safety Meeting Form**

Site Name & Number: _____

ATC Project Number: _____

Work Being Performed: _____

Date & Time of Meeting: _____

Name of Presenter: _____

NOTE: On the initial day of the project, the Project Manager or designee should conduct a visual inspection of the project site prior to the Tailgate Safety Meeting. This inspection should include a review of project site equipment, hazards, and specific job tasks, activities or operations to be performed for that day. These specific items must be covered during the Tailgate Safety Meeting. For subsequent days, any changes to the site or operations must be covered in the Tailgate Safety Meeting. In addition, “Task-Specific” Job Safety Analysis (JSA) for the tasks/activities at the project site must be integrated into the HASP and Tailgate discussions.

Itemize the Specific Topics Discussed (if more space is needed use the back of this page):

- | | | |
|--|---|---|
| <input type="checkbox"/> Are all employees okay? | <input type="checkbox"/> Are all employees physically able to perform their job duties? | <input type="checkbox"/> “Shared Learning” items? |
| <input type="checkbox"/> Has PPE been checked? | <input type="checkbox"/> Emergency evacuation area identified? | <input type="checkbox"/> Asked for Sub interactions or questions? |

- ☐ **Client Requirements** - By checking the box to the left, the Presenter of the Tailgate Meeting acknowledges that all Client-specific requirements have been completed for both ATC and Subcontractor employees.

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**Appendix 07-05
Tailgate Safety Meeting Form**

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Work Being Performed: _____

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**Appendix 07-05
Tailgate Safety Meeting Form**

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ATC Project Number: _____

Work Being Performed: _____

Date & Time of Meeting: _____

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NOTE: On the initial day of the project, the Project Manager or designee should conduct a visual inspection of the project site prior to the Tailgate Safety Meeting. This inspection should include a review of project site equipment, hazards, and specific job tasks, activities or operations to be performed for that day. These specific items must be covered during the Tailgate Safety Meeting. For subsequent days, any changes to the site or operations must be covered in the Tailgate Safety Meeting. In addition, “Task-Specific” Job Safety Analysis (JSA) for the tasks/activities at the project site must be integrated into the HASP and Tailgate discussions.

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HEALTH AND SAFETY PLAN (HASP) Air Quality Monitoring Record

[illegible]

HEALTH AND SAFETY PLAN (HASP)

Equipment Calibration Log

[illegible]

CHECKLIST FOR SUBSURFACE CLEARANCE

MUST be filled out PRIOR to the Start of Field Activities

NO subsurface work in road Right of Ways or Off-Site (property boundary) without Written Authorization

Person
Verifying
Each Item to
Place Initials
On Lines
Below and
Sign Bottom
of Page

Comments

Site Name

Site Address:

Project No.:

To understand and use this checklist correctly you must refer to and follow
ATC's Subsurface Investigation Procedures.

PRE-DRILLING PREPARATION

Review definition of "Critical" and "Non-Critical" areas.

Request as-built drawings, and/or approval to use private utility locator service and/or air
knife to locate/protect subsurface utilities.

Obtain Site access agreement.

Pre-plan boring locations.

Establish surface boring method.

Obtain permits and clearances.

Do borehole and utility markouts.

Establish Site-specific Health and Safety Plan

Notify Client, owner, operator prior to mobilization.

If not using Air Knife-type technology, why?

ON-SITE PROCEDURES

Conduct tailgate safety meeting with topics as indicated in procedure.

Read and follow Drilling/Probing procedures

--1. Do Site walk and verify that utility location checklist is complete.

--2. Locate all markouts and planned borehole locations. Start intrusive procedures at
least 5 feet away from and perpendicular to utility markouts.

--3. Break surface cover.

--4. Do surface boring to required depth using hand auger, post-hole digger, shovel or
"air knife".

--5. If necessary, use alternate procedure for surface boring.

--6. Collect soil samples by hand augering to required depth.

--7. Protect the borehole from pedestrian and vehicular traffic.

*Buried utilities can be found at any depth, but are most often found within the first 5 feet below the ground surface. Proceed
slowly and with extra caution when working within 5 feet of the ground surface.

NOTES:

SIGNATURE

DATE

MUST be filled out PRIOR to the Start of Field Activities

NO subsurface work in road Right of Ways or Off-Site (property boundary) without Written Authorization

Site Address: _____ If Present --

Site Safety Documents (on-site during activities)

Utility Staking Request Form (properly completed for current scope of work)?

Site Health and Safety Plan?

"Yes or No" Fill Out, as applicable

Yes No Ticket # and Expir. Date: # / /
Yes No Hospital Location Map Available Yes No

**Utility Identification "color"
Above Ground (AG) / Buried (B)**

Natural Gas (Yellow) / Staked? AG / B

Electrical (Red) / Staked? AG / B

Telephone/Fiber Optic (Orange) / Staked? AG / B

Cable TV (Orange) / Staked? AG / B

Water (Blue) / Staked? AG / B

Sewer (Green) / Staked? AG / B

Note: If any of the above listed utilities are not marked, contact the Project Manager immediately to discuss.

Identify on a Site Map the Location of ALL

Lines & Meters (or actual utility) and Indicate Nearest Building Quadrant (NE, SE, SW, or NW)

NW NE SE
Yes No SW
NW NE SE
Yes No SW
NW NE SE
Yes No SW
NW NE SE
Yes No SW
NW NE SE
Yes No SW

Significant Site Features

UST system (UST cavity, dispenser islands, piping runs, vent pipes etc.)?

Above Ground Storage Tanks – ASTs (dispenser islands, piping runs)?

Electrical Transformers?

Area Lighting (Pole mounted lighting, etc.)?

Signage with electrical power (Business/Company signs, etc.)?

Underground lawn/landscaping sprinkler system?

Storm drain catch basins / man-ways and potential connecting conduits/lines?

Yes No
Yes No
Yes No
Yes No
Yes No
Yes No
Yes No

Site Feature Located in Closest Property Quadrant

(NE, SE, SW, or NW). Also Identify on Site Map.

Other

Pavement distress (Cracked pavement, "buckled" asphalt, etc.)?

Yes No

"Other" Concerns Located in Closest Property Quadrant (NE, SE, SW, or NW). Identify on Site Map.

*Buried utilities can be found at any depth, but are most often found within the first 5 feet below the ground surface. Proceed slowly and with extra caution when working within 5 feet of the ground surface.

SIGNATURE

DATE

Monthly Mobile/Heavy Equipment Safety Inspection Checklist

This form is to be completed by the qualified operator of the equipment

Date:		Project No.:		Site/Location :	
Equipment Type:				Model No.:	
Operator/Inspector Name:					Machine Hours:
Warning: Do not operate a malfunctioning machine until corrective measures have been taken and all discrepancies have been cleared by a qualified operator/mechanic. In addition to elements on this checklist, the owner's manual for the specific piece of equipment being operated may contain other daily inspection checks and/or preventative maintenance procedures.					
General Safety	<input type="checkbox"/>	Operator Qualification	<input type="checkbox"/>	PPE Supplies	<input type="checkbox"/>
	<input type="checkbox"/>	Owner's Manual (present)	<input type="checkbox"/>	DriverCheck (decal in place)	<input type="checkbox"/>
	<input type="checkbox"/>	Manufacturer Specs Followed	<input type="checkbox"/>	Access Ladder (secure and ok)	<input type="checkbox"/>
	<input type="checkbox"/>	Emergency Kit (signs, flares)	<input type="checkbox"/>	Flashlight	<input type="checkbox"/>
Vehicle, Engine, and Hydraulic Systems (note any added fluid)	<input type="checkbox"/>	Engine Oil (fluid level, condition)	<input type="checkbox"/>	Fuel Level	<input type="checkbox"/>
	<input type="checkbox"/>	Transmission (fluid level, fluid condition, unit operation)	<input type="checkbox"/>	Brake Fluid	<input type="checkbox"/>
	<input type="checkbox"/>	Radiator (coolant level, hose condition)	<input type="checkbox"/>	Fan Belts (tension/condition)	<input type="checkbox"/>
	<input type="checkbox"/>	Hydraulic System (fluid level, fluid condition, hose condition, cylinders, leakage)	<input type="checkbox"/>	Chassis (proper lubrication)	<input type="checkbox"/>
	<input type="checkbox"/>	Outriggers (operational, if equipped)	<input type="checkbox"/>		<input type="checkbox"/>
Tracked Vehicles	<input type="checkbox"/>	Track Tension (proper tension)	<input type="checkbox"/>	Plates and/or Shoes	<input type="checkbox"/>
	<input type="checkbox"/>	Rollers	<input type="checkbox"/>	Drive Sprockets	<input type="checkbox"/>
Lights and alarms (clean and functional)	<input type="checkbox"/>	Headlights (hi, low, run beams)	<input type="checkbox"/>	Parking Lights	<input type="checkbox"/>
	<input type="checkbox"/>	Reverse Lights (backup)	<input type="checkbox"/>	Equipment Work Lights	<input type="checkbox"/>
	<input type="checkbox"/>	Brake/Tail Lights	<input type="checkbox"/>	Turn Signals/Hazard Flashers	<input type="checkbox"/>
Vehicle cab (clean and functional)	<input type="checkbox"/>	Seatbelts (if required)	<input type="checkbox"/>	Windshield Wipers	<input type="checkbox"/>
	<input type="checkbox"/>	Housekeeping	<input type="checkbox"/>	2 Way Communication	<input type="checkbox"/>
	<input type="checkbox"/>	Fuel Gauge	<input type="checkbox"/>	Horn (operational)	<input type="checkbox"/>
	<input type="checkbox"/>	Controls Operational	<input type="checkbox"/>	Mirrors (rear view, side)	<input type="checkbox"/>
Maintenance/ Equipment Request			Corrected By:		Date:
Inspectors Signature:					
					Date



Appendix 27-6
Voluntary Respirator Use Form

Please Read:

Respirators are an effective method of protection against designated hazards when properly selected and worn. Respirator use is encouraged, even when exposures are below the exposure limit, to provide an additional level of comfort and protection. However, if a respirator is used improperly or not kept clean, the respirator itself can become a hazard to you. Sometimes employees may wear respirators to avoid exposures to hazards, even if the amount of hazardous substances does not exceed the limits set by OSHA standards. If respirators are provided to you by ATC for your voluntary use, or if you provide your own respirator, you need to take certain precautions to be sure that the respirator itself does not present a hazard.

You should do the following:

1. Read and heed all instructions provided by the manufacturer on use, maintenance, cleaning and care, and warnings regarding the respirator's limitations.
2. Choose respirators certified for use to protect against the contaminant or concern. NIOSH, the National Institute for Occupational Safety and Health of the U.S. Department of Health and Human Services, certifies respirators. A label or statement of certification should appear on the respirator or respirator packaging. It will tell you what the respirator is designed for and how much it will protect you.
3. Do not wear your respirator into atmospheres containing contaminants for which your respirator is not designed to protect against. For example, a respirator designed to filter dust particles will NOT protect you against gases, vapors, or very small particles of fumes or smoke.
4. Keep track of your respirator so that you do not mistakenly use someone else's respirator.
5. Wearing of any tight-fitting respirator requires your participation in the ATC Respiratory Protection Program and must be first approved by the Branch Safety Officer and meet all of the applicable requirements of ATC Health & Safety Manual section 27 – Respiratory Protection.

By my signature below, I certify that I have read, understand and agree to the information provided on this form.

Signature

Printed Name

Date

APPENDIX D

Excavating & Trenching

All ATC employees and subcontractors shall be trained and be familiar with the OSHA Excavation Standard and the ATC Employee Health and Safety Policy Manual, Policy No. 16 (Excavation and Trenching) and Policy No. 33 (Subsurface Investigation).

1.0 UNDERGROUND UTILITIES

Prior to any work beginning, the estimated location of utility installations (such as sewer, telephone, fuel, electric, water lines, or any other underground installation) that reasonably may be expected to be encountered during excavation work must be determined prior to opening an excavation. Utility companies or owners shall be contacted and advised of the proposed work and asked to establish the location of the utility underground installations. When utility companies or owners cannot respond to a request to locate underground utilities within 24-48 hours (unless a longer period is required by State or local law), or cannot establish the exact location of these installations, the work may proceed, provided that the work is conducted with caution, and provided detection equipment or other acceptable means to located utilities are used.

When excavation operations approach the estimated location of underground installations (approximately 18 inches from the installation), the exact location of the installations shall be determined by a safe and acceptable means. While the excavation is open, underground installations shall be protected, supported, or removed to safeguard employees.

2.0 ENTERING EXCAVATIONS OR TRENCHES

Daily inspections of excavations, the adjacent areas, and protective systems shall be made by a "*Competent Person*" for evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. An inspection shall be conducted by the Competent Person prior to the start of work and as needed throughout the shift. Inspections shall also be made after every rainstorm or other hazard-increasing occurrence. All inspections made by the Competent Person should be recorded in the field log book.

No person(s) shall perform work in a trench or excavation that contains accumulated water.

2.1.1 Access/Egress

A stairway, ladder, ramp, or other safe means of egress shall be located in trench excavations that are 4 feet or more in depth so as to require no more than 25 feet of lateral travel distance in any direction.

2.1.2 Exposure to Falling Loads

No employee or subcontractor is permitted underneath loads handled by lifting or digging equipment. All personnel shall be required to stand away from any vehicle being loaded or unloaded to avoid being struck by spilling or falling materials. Operators may remain in the cabs of vehicles being loaded or unloaded when the equipment is provided with a cab shield and/or canopy adequate to protect the operator from falling materials.

2.1.3 Warning Systems

When mobile equipment is operated adjacent to an excavation and the operators/drivers do not have a clear and direct view of the edge of the excavation, a warning system such as barricades, hand or mechanical signals, or stop logs are required.

APPENDIX D

Excavating & Trenching

2.1.4 Protection from Loose Rock or Soil

Adequate protection shall be provided to protect employees from loose rock or soil that could pose a hazard to personnel in the excavation. All temporary spoil piles shall be kept at least 2 feet away from the edge of the excavation. Spoil piles should be placed to channel rainwater or other run-off water away from the excavation.

2.1.5 Hazardous Atmospheres

All excavations deeper than 4 feet deep and which have the potential to have a hazardous atmosphere or oxygen deficient atmospheres (Less than 19.5% oxygen) must be tested to ensure safe working conditions, prior to entry. Air monitoring shall be conducted in accordance with Section 4.0 of the HASP.

2.1.6 Protective Systems

Each employee in an excavation shall be protected from cave-ins by an adequate protective system except when excavations are made entirely in stable rock or the excavation is less than 5 feet in depth and examination by the Competent Person provides no indication of a potential cave-in. Protective systems consist of sloping or benching, use of trench boxes or other shielding mechanisms, or the use of a shoring system in accordance with the regulations.

APPENDIX E

Lockout/Tagout Requirements & Procedures

1.0 DEFINITIONS

1. Lockout – Involves using a device such as a padlock, blank pipe flange, chain key block, etc. to isolate energy from employee exposure.
2. Tagout – Involves applying a tag to the energy isolating device with written information concerning the date and name of person who applied the lock and tag.

2.0 LOCKOUT/TAGOUT POLICY

This procedure establishes the minimum requirements for lockout/tagout of electrical energy sources, mechanical, hydraulic, pneumatic, thermal or chemical process energy. It is to be used to ensure that conductors and circuit parts are disconnected from sources of electrical energy, locked (tagged), and tested before work begins where employees or subcontractor could be exposed to dangerous conditions. Sources of stored energy, such as capacitors or springs, shall be relieved of their energy, and a mechanism shall be engaged to prevent the re-accumulation of energy.

Lockout/tagout procedures shall be used prior to performing tie-in operations, maintenance, repair or adjustment of any device where exposure to hazardous energy sources may occur.

3.0 RESPONSIBILITY

All affected employees and subcontractors shall be instructed in the safety significance of the lockout/tagout procedure. All new or transferred employees and all other persons whose work operations are or might be in the area shall be instructed in the purpose and use of this procedure. The ATC Project Manager shall ensure that appropriate personnel receive instructions on their roles and responsibilities. All persons installing a lockout/tagout device shall sign their names and the date on the tag and on the Lockout/Tagout Isolation Record (see Appendix E.1).

4.0 PREPARATION FOR LOCKOUT/TAGOUT

1. Review current diagrammatic drawings (or other equally effective means), tags, labels, and signs to identify and locate all disconnecting means to determine that the source of energy is interrupted by a physical break and not deenergized by a circuit interlock. Make a list of disconnecting means to be locked/tagged.
2. Review other work activities to identify where and how other personnel might be exposed to sources of energy. Establish energy control methods for control of other hazardous energy sources in the area.
3. Provide an adequately rated voltage detector to test each electrical phase conductor or circuit part to verify that they are deenergized. Test the voltage detector to make sure that it is working properly.

5.0 LOCKOUT PROCEDURE

1. Complete the Lockout/Tagout Isolation Record (see Appendix E.1).
2. All affected employees in the area shall be notified that a lockout is being performed.
3. The equipment being locked out shall be shut down using normal shutdown procedures. (i.e. operator's control station, stop button, etc.).
4. Any residual energy shall be identified and dissipated at this time.

APPENDIX E

Lockout/Tagout Requirements & Procedures

5. All equipment energy sources shall be neutralized. (i.e. electrical disconnects shall be opened, valves closed, blanks inserted in piping, springs returned to neutral position, other energy sources as required)
6. The qualified employee performing the lockout shall place his/her personal lock and tag on EACH energy isolation point isolated in Step 4. If more than two (2) isolation points are required to lockout the device, a group lockbox may be used. A tag indicating all persons who applied a lock, date, time, equipment type, and number and duration of lockout shall also be applied at this time. A subcontractor representative and an ATC employee shall also apply a lock at this time.
7. Test the lockout by clearing the area and attempting to operate the machine or attempting to operate disconnecting means to determine that the operation is prohibited. A voltage-detecting instrument should be used for electrical components. Inspect the instrument prior to use for physical damage and operation.

6.0 REMOVAL OF LOCKOUT/TAGOUT

1. Upon completion of the lockout an authorized employee must check the area for completeness of work. If the employee who initiated the lockout is available, he/she should conduct this inspection.
2. Remove all tools and nonessential items from the area.
3. Replace all guards.
4. Ensure all employees are clear of the equipment/process.
5. Notify all affected employees in the area that the lockout device(s) are being removed.
6. Remove lockout device(s).
7. Restart the machine to insure proper operation.

7.0 GROUP LOCKOUT

1. When multiple isolation points, three (3) or more, must be controlled during a lockout, or when multiple persons (craft) are involved, a group lockout shall be used.
2. Follow the steps for a normal lockout as documented in steps 1-6 above.
3. Each key for the locks used shall be placed in a group lockout box. The group lockbox shall be kept in view of the work being performed when practical.
4. A Job Control Lock shall be installed on the group lockbox by an ATC Employee. This lock shall remain in place until the lockout has been completed.
5. Each employee shall remove their own lock when their portion of the work is completed or at the end of each shift.
6. Upon completion of the work, the ATC employee shall inspect the work area for completeness.
7. When all of the conditions of the lockout termination procedures have been satisfied, the Job Control Lock shall be removed from the group lockbox.

APPENDIX E

Lockout/Tagout Requirements & Procedures

8.0 EMERGENCY REMOVAL LOCKOUT/TAGOUT DEVICE

1. If an employee leaves the facility without removing his/her lock and tag, an effort shall be made to notify the employee that the supervisor in charge will authorize the removal of their lock. It must be deemed necessary that removal of the lock is required by at least two supervisory personnel, but only after confirming beyond any doubt it is safe to do so.
2. Verify the employee has left the Site.
3. Check with co-workers.
4. Check the employee's time card.
5. Attempt to reach him/her at home.
6. Verify the employee is not in the equipment.
7. Visually confirm the completeness of work.
8. Contact the Regional Safety Coordinator and the Project Manager.
9. An authorized employee, under the direct supervision of an ATC Supervisor shall remove the lock.
10. Upon return to the Site by the employee involved, he/she shall be informed of the removal.
11. A review of the incident may be conducted by the ATC RSC Coordinator to determine any disciplinary actions necessary.

APPENDIX E-1

Lockout/Tagout Isolation Record

System:			Isolation Record			Status	Tagging Authority	
Equipment Tag:			Equipment Description:			<input type="checkbox"/> Construction		
						<input type="checkbox"/> Startup		
						<input type="checkbox"/> Operations		
LOTO No.	DNO Tag No.	Equipment Tag No.	Equipment Description	Pos.	LOTO Placed By:	Date	LOTO Removed BY:	Date
Tagging Authority Approval:								
		Signature				Date		
Holder List:								
PTW No.	Signed Onto LOTO Name			Date / Time	Signed Off LOTO Name			Date / Time